FURUNO

OPERATOR'S MANUAL

DOPPLER SONAR
CURRENT INDICATOR

MODEL **CI-35/35H**

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(TATA) CI-35/35H

Your Local Agent/Dealer

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SAFETY INSTRUCTIONS

"**DANGER**", "**WARNING**" and "**CAUTION**" notices appear throughout this manual. It is the responsibility of the operator of the equipment to read, understand and follow these notices. If you have any questions regarding these safety instructions, please contact a FURUNO agent or dealer.

DANGER	This notice indicates a potentially hazardous situation which, if not avoided, will result in death or serious injury.
WARNING	This notice indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	This notice indicates a potentially hazardous situation which, if not avoided, could result in minor or moderate injury, or property damage.

⚠ WARNING



Do not open the cover of the equipment.

This equipment uses high voltage electricity which can shock, burn, or cause death. Only qualified personnel should work inside the equipment.

Do not disassemble or modify the equipment.

Fire, electrical shock or serious injury can result.

Immediately turn off the power at the ship's mains switchboard if water or foreign object falls into the equipment or the equipment is emitting smoke or fire.

Continued use of the equipment can cause fire, electrical shock or serious injury.

⚠ CAUTION

Do not place liquid-filled containers on the top of the equipment.

Fire or electrical shock can result if a liquid spills into the equipment.

Do not place heater near the equipment.

Heat can melt the power cord, which can result in fire or electrical shock.

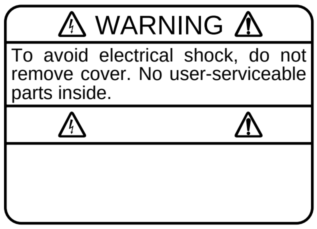
Do not operate the unit with wet hands.

Electrical shock can result.

Use the correct fuse.

Use of the wrong fuse can cause fire or equipment damage.

A warning label is attached to the equipment. Do not remove the label. If the label is missing or damaged, contact a FURUNO agent or dealer about replacement.



Name: Warning Label (1)
Type: 86-003-1011-0
Code No.: 100-236-230

CONTENTS

TABLES FOR RECORDING USER PRESETS

The CI-30/35H provides menus to preset, various measuring and display conditions to customize the equipment precisely for your operating conditions.

The form below is provided to record user presets, so they can be restored in the event of loss by misoperation or by maintenance/service work.

1) BASIC MENU (Display/measuring conditions)

[MENU 1]

	ITEM	USER PRESET	√ : selected					FAC. SETTING
◎	REF TIDE DIF	☐ LAYER1	☐ LAYER2	☐ LAYER3				LAYER1
*	TIDE AVERAGE	☐ 0 min	☐ 1 min	☐ 2 min	☐ 3 min	☐ 4 min	☐ 5 min	2 min (**)
◎	TIDE HISTORY	☐ 15 sec	1 min	☐ 5 min	☐ 10 min	☐ 30 min	☐ 1 hour	15 sec
◎	LAYER1	☐ ON	☐ OFF					ON
◎	LAYER2	☐ ON	☐ OFF					ON
◎	LAYER3	☐ ON	☐ OFF					ON
◎	TIDE DIF DSP	☐ ON	☐ OFF					ON
◎	DRIFT DSP	☐ DRIFT	☐ SPEED	☐ OFF				DRIFT
◎	TEMP DSP	☐ ON	☐ OFF					ON
◎	ECHO LEV DSP	☐ COLOR	☐ GRAPH					COLOR
◎	BACKGROUND	☐ NORMAL	☐ 1	☐ 2	☐ 3			NORMAL

(**) "2 min" or longer averaging time is desirable to obtain stable and smooth response of tide/tide differential display.

[MENU 2]

	ITEM	USER PRESET	√ : selected		FAC. SETTING
◎	REF DEPTH	☐ OFF	☐ E/S		OFF
*	MENU SELECT	☐ LOCK	☐ UNLOCK		LOCK

[MENU 3]

	ITEM	USER PRESET	√ : selected				FAC. SETTING
◎	SHIP SPD AVE	☐ 15 sec	☐ 30 sec	☐ 60 sec	☐ 90 sec		15 sec
*	DRAFT	[ ] m	0.0 to 25.6 m				0.0 m
*	WT SPD DEPTH	[ ] m	0.0 to 25.6 m				2.0 m
*	HEEL ANGLE	[ ] °	-12.8 to +12.7°				0.0°
*	TRIM ANGLE	[ ] °	-12.8 to +12.7°				0.0°
*	GT SPD CALIB	[ ] %	-12.8 to +12.7%				0.0%
*	WT SPD CALIB	[ ] %	-12.8 to +12.7%				0.0%
*	BEARING CALIB	[ ] °	-12.8 to +12.7°				0.0°
*	EXT KP1 DIST	[ ] m	0.0 to 25.6 m				0.0 m
*	EXT KP2 DIST	[ ] m	0.0 to 25.6 m				0.0 m
*	BTM TIDE TRK	☐ OFF	☐ ON				OFF

	ITEM	USER PRESET √ : selected						FAC. SETTING
*	TIME DATA	☐ INT	☐ EXT					INT
◎	WT SPEED	☐ T/D	☐ NAV-TIDE					T/D
*	NAV FORMAT	☐ CIF	☐ NMEA					CIF
*	NAV AID	☐ GPS	☐ LORAN-C	☐ DECCA	☐ DR	☐ LORAN-A	☐ ALL	ALL
*	NAV DATA	☐ L/L	☐ SPD					SPD
*	TIME INT	[ ] min	1 to 10 min (in 1 min steps)					1 min
*	CRS CAL MODE	☐ GT	☐ NAV	☐ MAN				MAN
*	CRS CAL EXEC	START	To start calibration, select START and press EVENT key.					- -
*	TIDE OUT INT	☐ 15 sec	☐ 30 sec	☐ 1 min	☐ 2 min	☐ 5 min	☐ 10 min	15 sec

2) RANGE MENU (Speed/distance/depth ranges)

	ITEM	USER PRESET		FAC. SETTING
◎	SPEED RANGE	[ ] kt	1.0 to 30.0 kt	2.0 kt
◎	DIST RANGE	[ ] NM	0.1 to 5.0 NM	1.0 NM
◎	ECHO DEPTH	[ ] m	50 to 700 m	50 m
◎	ECHO SHIFT	[ ]	1 to 36	1

3) RANGE MENU

	ITEM		SET ON/OFF	MIN	MAX	SP ON/OFF	FAC. SETTING
◎	1ST LAYER	SPD	☐ ON ☐ OFF	[ ] kt	[ ] kt	☐ ON ☐ OFF	SET OFF / SP ON
		DIR	☐ ON ☐ OFF	[ ]°	[ ]°	☐ ON ☐ OFF	SET OFF / SP ON
◎	2ND LAYER	SPD	☐ ON ☐ OFF	[ ] kt	[ ] kt	☐ ON ☐ OFF	SET OFF / SP ON
		DIR	☐ ON ☐ OFF	[ ]°	[ ]°	☐ ON ☐ OFF	SET OFF / SP ON
◎	3RD LAYER	SPD	☐ ON ☐ OFF	[ ] kt	[ ] kt	☐ ON ☐ OFF	SET OFF / SP ON
		DIR	☐ ON ☐ OFF	[ ]°	[ ]°	☐ ON ☐ OFF	SET OFF / SP ON
◎	SHALLOW T/D	SPD	☐ ON ☐ OFF	[ ] kt	[ ] kt	☐ ON ☐ OFF	SET OFF / SP ON
		DIR	☐ ON ☐ OFF	[ ]°	[ ]°	☐ ON ☐ OFF	SET OFF / SP ON
◎	DEEP T/D	SPD	☐ ON ☐ OFF	[ ] kt	[ ] kt	☐ ON ☐ OFF	SET OFF / SP ON
		DIR	☐ ON ☐ OFF	[ ]°	[ ]°	☐ ON ☐ OFF	SET OFF / SP ON
◎	SHIP SPEED	SPD	☐ ON ☐ OFF	[ ] kt	[ ] kt	☐ ON ☐ OFF	SET OFF / SP ON
		CRS	☐ ON ☐ OFF	[ ]°	[ ]°	☐ ON ☐ OFF	SET OFF / SP ON
◎	TRIP	DIST	☐ ON ☐ OFF	[ ] NM	[ ] NM	☐ ON ☐ OFF	SET OFF / SP ON
		TIME	☐ ON ☐ OFF	[ ]	[ ]	☐ ON ☐ OFF	SET OFF / SP ON

Marks on the ALARM MENU
Filled star (★) : alarm active Hollow star (☆) : alarm inactive
Active speaker (🔊) : speaker enabled Inactive speaker (🔈) : speaker disabled

Note: 1. Descriptions of menu items and the procedures for presetting them begin on page 4-1.
2. To clear user presets and automatically restore factory settings, select “FACTORY” on the BASIC MENU2- “MENU SET”. (Note that the user presets for “TEMP DSP” and “ECHO LEV DSP” in MENU1 are not cleared by this operation.)
3. Items marked with “ ◎ ” are user changeable.
Items marked with “*” should not be changed needlessly once they are set at installation. Needless change can degrade the accuracy of measurements.

IMPORTANT NOTICE ON TIDE MEASUREMENTS

(In nav-aided mode, tide accuracy depends heavily on gyro accuracy.)

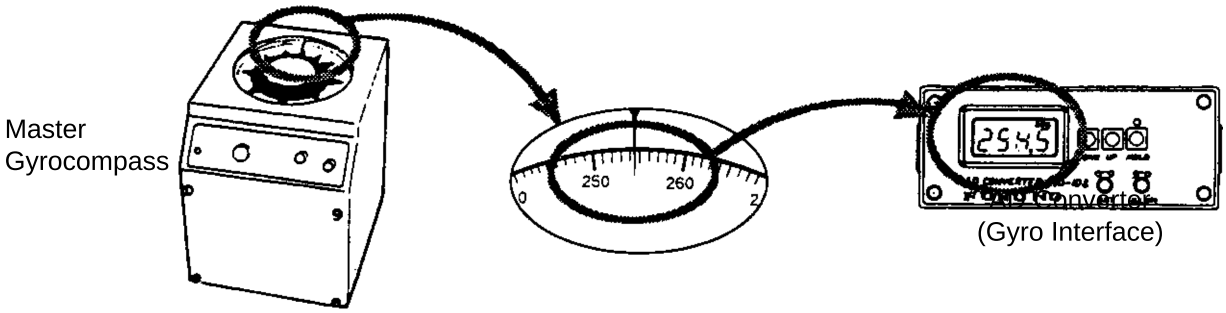
SETTING SHIP'S HEADING

The CI-35/35H has the nav-aided mode to measure absolute tides even in deep waters where ground tracking is unattainable. To achieve reliable measurements, however, you must supply accurate heading (gyro) information and ship's position (or speed/course) data to the CI-35/35H.

If you are going to use nav-aided mode, set the reading of the AD converter (gyro interface) exactly with that of master gyrocompass.

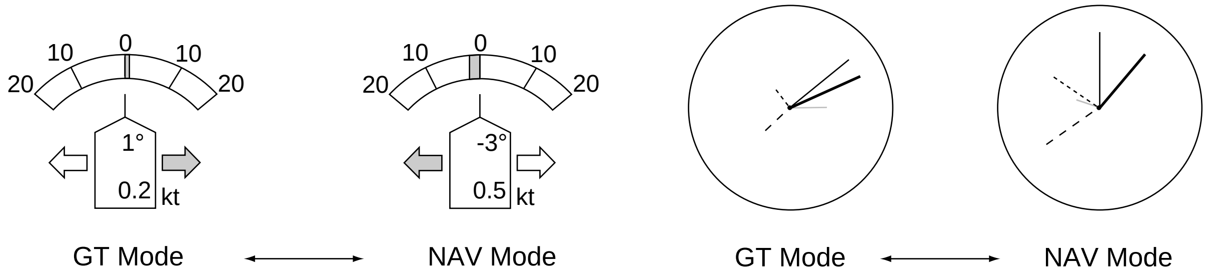
Procedure

1. Confirm that the gyrocompass has settled and all the necessary compensations (latitude compensation, weather compensation, etc.) are made correctly.
2. Manipulate the AD converter to obtain the same reading as you read on the master gyrocompass. (Do not make adjustment while the ship is turning.)



If the gyro reading is accurate enough, the CI-35/35H should provide accurate tide information. If the gyro data contains some error, however, you may see the following symptoms.

- Set/drift information on nav-aided mode differs from that on ground-tracking mode.
- Tide/tide differential information on nav-aided mode differs from that on ground-tracking mode.

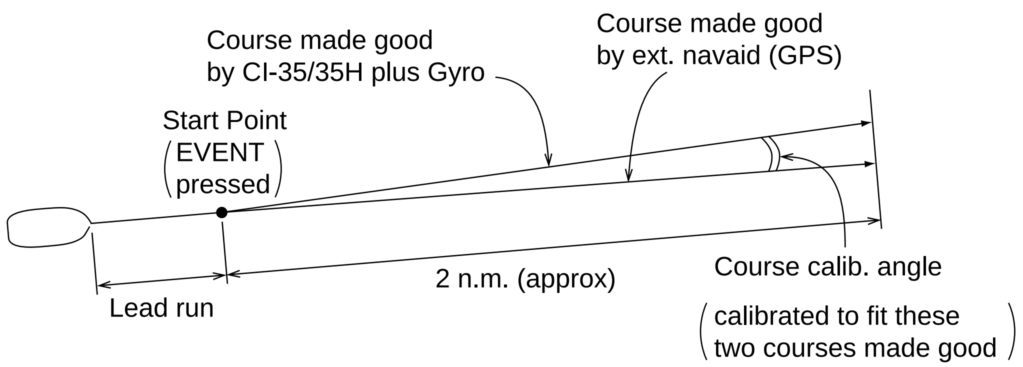


If you encounter with such symptoms, perform the calibration following the procedure on the next page.

CALIBRATING COURSE OFFSET (Automatic)

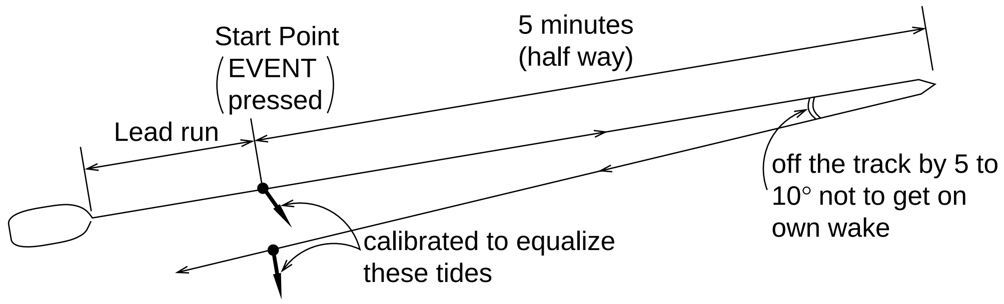
A. When ground-tracking is attainable:

1. Make sure the navaid (GPS) is working correctly and accurately.
2. On CI-35/35H, select ground tracking mode. (Press the TRACKING MODE key to see the "GT" mode indication on the display.)
3. In Menu 4, set 'CRS CAL MODE' to "GT".
4. Run your boat at a speed about 10 kts, keeping the same direction. To minimize the effect of gyro speed error, it is desirable to run along parallels (i.e., eastward or westward).
5. In Menu 4, place the cursor on "START" ('CRS CAL EXEC') and then press the EVENT key. As soon as you press the EVENT, "0.0" should appear in reverse text at the upper-right part of the display. After 2 mile-run, the display will show the course calibration angle (result of calculation) in normal text.



B. When ground-tracking is unattainable:

1. Make sure the navaid (GPS) is working correctly and accurately.
2. On CI-35/35H, select nav-aided mode. (Press the TRACKING MODE key to see the "NAV" mode indication on the display.)
3. In Menu 4, set 'CRS CAL MODE' to "NAV".
4. Run your boat at a speed about 10 kts, keeping the same direction. To minimize the effect of gyro speed error, it is desirable to run along parallels (i.e., eastward or westward).
5. In Menu 4, place the cursor on "START" ('CRS CAL EXEC') and then press the EVENT key. As soon as you press the EVENT, "0.0" should appear in reverse text at the upper-right part of the display.
6. When the boat has run for 5 minutes, turn your heading almost 180˚ and steer back to the start point. After 10 minute-run, the display will show the course calibration angle (result of calculation) in normal text.



WHY IS GYRO DATA IMPORTANT IN NAV-AIDED MODE?

If you consider the difference of tide vector calculations is ground-tracking mode and in nav-aided mode, you will realize how important the gyro (heading) information is.

Tide Calculation in Ground-Tracking Mode

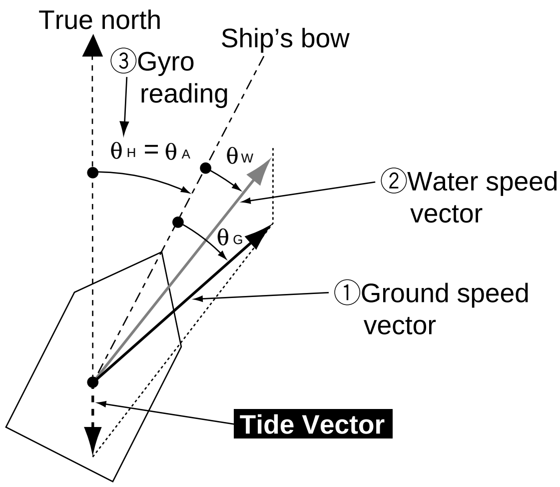
In ground-tracking mode, the CI-35/35H derives tide information from the following data.

(1) Ship's speed/course based on ground (ground speed)

(2) Ship's speed/course based on target layer (water speed)

(3) Bearing of ship's bow (Heading by gyro)

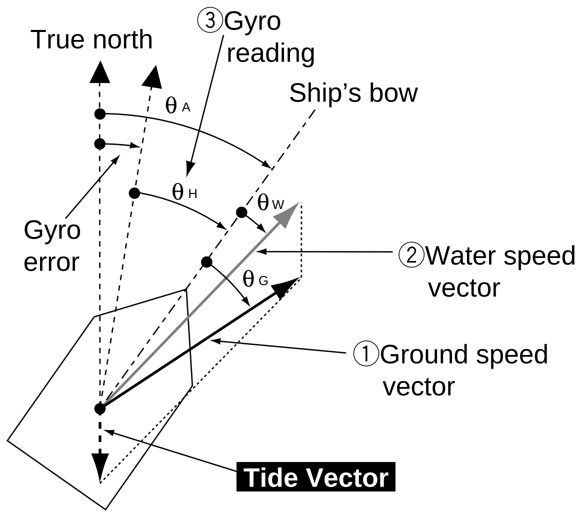
θ_A: True bearing of ship's bow (ref. north)
θ_H: Gyro reading
θ_G: Direction of ground speed (ref. bow)
θ_W: Direction of water speed (ref. bow)



Without gyro error

Both ground speed (1) and water speed (2) are sensed by the common transducers mounted on the hull. Thus, they are the speed vectors with respect to the ship's bow. No matter what the true bearing of ship's heading be, the relative angle of these two vectors does not change. The tide vector is simply given as the difference of these two speed vectors.

The heading data by gyro (3) is used after the tide vector calculation just to express the vector directions in true bearings (north referenced).



With gyro error

True bearing of each speed vector contains fixed error. But, their sizes and relative angles are maintained despite the gyro error.

Even if the gyro data contains error, the sizes and relative angles of vectors do not change. The gyro error only affects the bearing indication of each vector.

Tide Calculation in Nav-Aided Mode

In nav-aided mode, the CI-35/35H derives tide information from the following data.

(1) Ship's speed/course sensed by the external navigator (GPS)
(nav speed = pseudo ground speed)

(2) Ship's speed/course based on target layer
(water speed)

(3) Bearing of ship's bow
(Heading by gyro)

(θ_A: True bearing of ship's bow (ref. north)
θ_H: Gyro reading
θ_N: True bearing of nav speed (ref. north)
θ_W: Direction of water speed (ref. bow))

Here, nav speed (1) is the ship's speed vector sensed by the external navigator, and the moving direction is expressed with respect to true north.

While the water speed (2) is the ship's speed vector measured by CI-35/35H using the Doppler shifts against the measuring layer, and accordingly its direction is expressed with respect to the ship's bow.

As the directional reference of these two vectors are different (north vs ship's bow), we can not simply calculate the difference of vectors to obtain the tide vector in question.

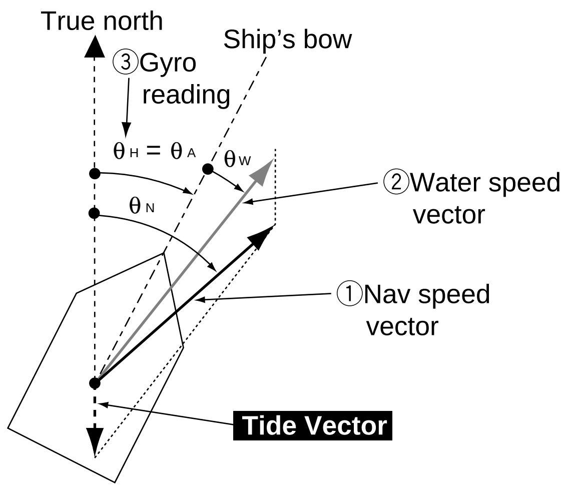
So the direction of water speed vector (2) is converted to true bearing (north reference) by using the gyro data, and then the tide vector is calculated.

If the gyro data contains some error, the true bearing of the water speed vector changes (rotates) accordingly. While the bearing of the nav speed vector does not change with the gyro error. (The relative angle of these two changes.)

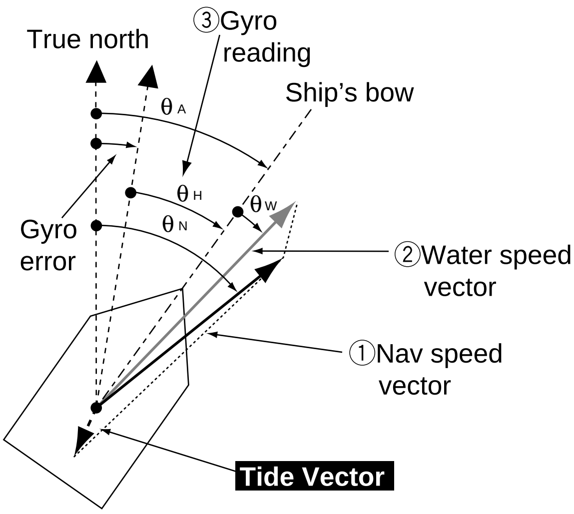
In other words the tide vector, given as a difference of these two speed vectors, changes in size (speed) and bearing by the gyro error. (Error in size and bearing mean the tide vector is unreliable and useless.)

You may now realize that the gyro data in nav-aided mode is very important and it has to be accurate enough for reliable tide data.

To obtain dependable tide/tide differential data, it is desirable to reduce the gyro error below 1 degree.



Without gyro error



With gyro error

Relative angle of water speed vector and nav speed vector changes with gyro error. Accordingly, the size (speed) and direction of tide vector change.

Note: The depth must be at least 40 m in order to calculate tide.

CHAPTER 1. GENERAL

1. FEATURES

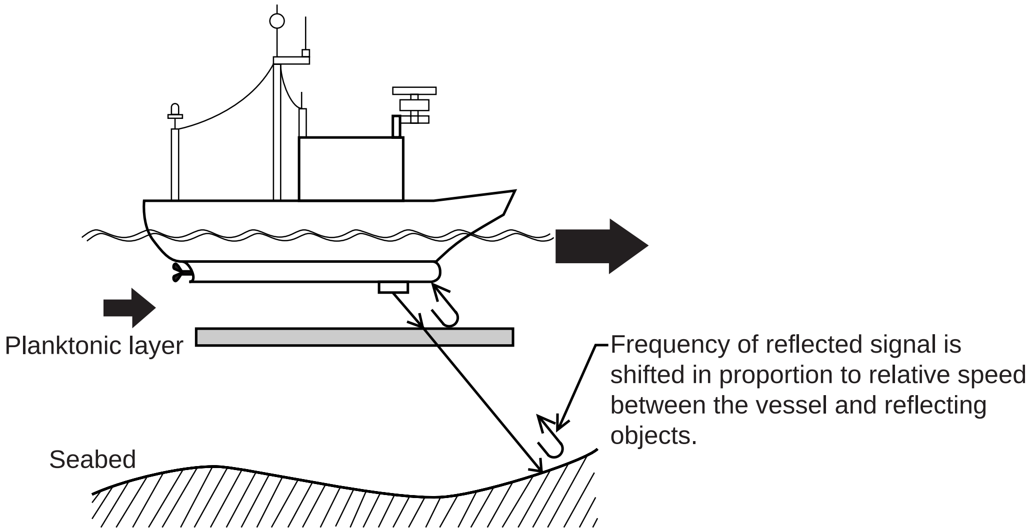
- The functions of CI-35 and CI-35H are same. CI-35H is type approved by MOT (Ministry of Transportation).
- Even in deep waters where ground (bottom) reference is not available acoustically, the CI-35/35H can provide absolute movements of measuring layers by receiving position (or speed) data from GPS navigator and heading data from gyro compass. It may be used on deep sea fishing boats or on ocean research vessels.
- The CI-35/35H consists of three major units; display unit; transceiver unit and hull unit (transducer), each compact enough to permit installation even on a small boat.
- Triple-beam system for automatic error compensation against pitching and rolling of vessel. Single-mold transducer makes installation easy while maintaining mechanical beaming accuracy.
- Sounding frequency of 130 kHz provides high interference immunity from other acoustic equipments. Intelligent digital signal processing technique adds tracking stability and measuring accuracy.
- Echo level display always on screen. Permits constant monitoring of signal conditions of three sounding beams.
- Tide effect display plots movements of tides beneath the vessel’s course track. Helpful in estimating three-dimensional deformation of cast net.
- Tide history display presents change of tide over last 24 sample points (24 hours maximum)
- Raw data output port provided for collecting and analyzing current data on a separate computer.

Note: When transmitting with the external transmission pulse (KP) taken from an external device (echosounder, sonar, etc.), the repetition rate of the KP should be more than 500 ms. The repetition rate may become shorter than 500 ms when the range setting on the external device is less than 100 m. Therefore, set the range on the external device to more than 100 m.

2. PRINCIPLE OF MEASUREMENT

When a moving vessel emits an acoustical pulse into the water at an angle, a portion of emitted energy is reflected from the seabed and other microscopic objects in the sound path, such as plankton or air bubbles. The frequency of the received signal is shifted from the transmitted frequency in proportion to relative velocity between the vessel and underwater reflecting objects. This is called Doppler Effect.

The CI-35/35H calculates and displays movements of ship and currents at specific depths by measuring Doppler shifts obtained from three separate directions.



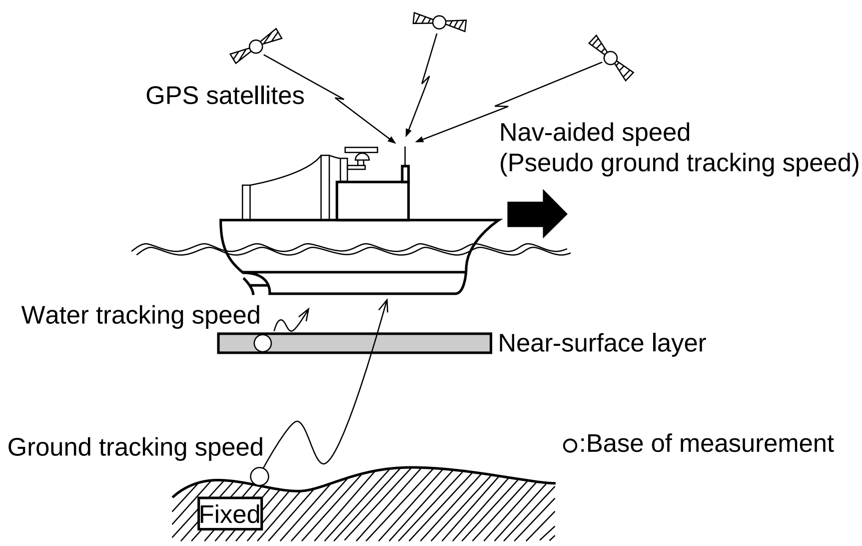
Ship's Speed (Here, speed is a vector value including velocity and direction.)

Depending on the base of measurement, ship's speed is expressed in two ways:

Ground tracking speed: (Absolute speed) — Ship's speed and course relative to seabed (fixed base)

Water tracking speed: (Relative speed) — Ship's speed and course relative to water layer just below the vessel (floating base)

Nav-aided speed: (Absolute speed) — Ship's speed and course obtained by external navigation equipment (GPS)



Tide

Tide is movement of watermass at a particular depth.

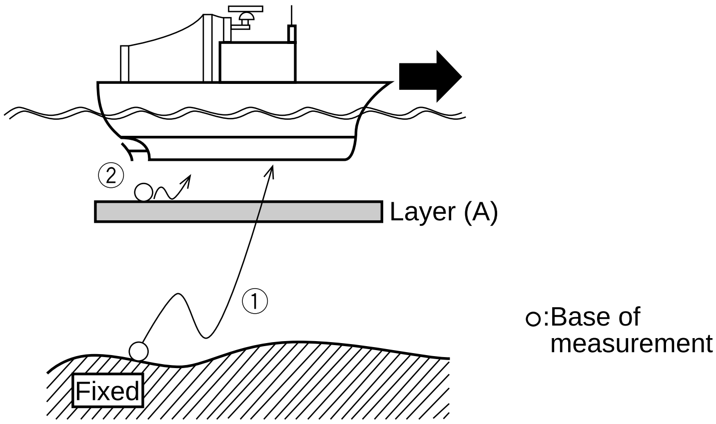
To know absolute tide (speed on ground), the following two data are required:

1 Ship's speed and course based on ground

2 Ship's speed and course based on measuring layer (A)

Absolute tide is, then, given as a difference of these two speed vectors.

Absolute Tide = 1 - 2



Nav-Tide

Nav-Tide is an absolute movement of watermass at a particular depth, taking speed information from the external navigator (GPS) as a pseudo ground tracking speed.

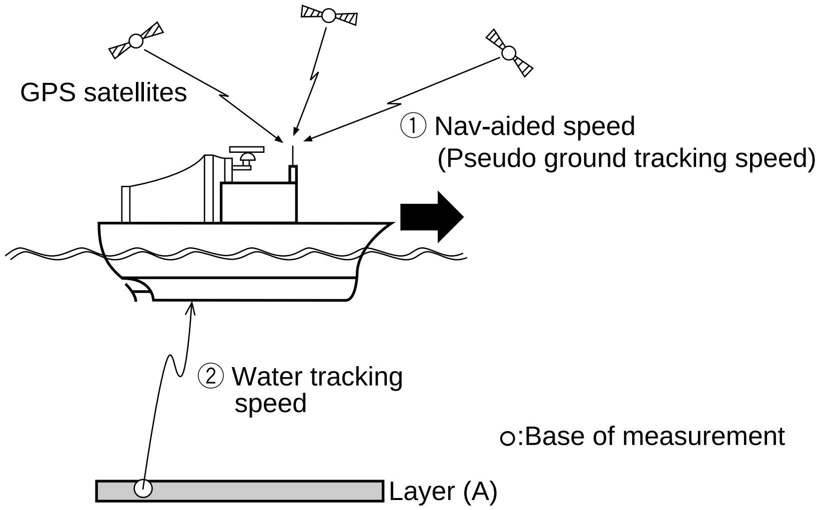
To calculate Nav-tide, the following two data are required:

1 Ship's speed and course obtained by external navigation equipment (GPS)

2 Ship's speed and course based on measuring layer (A)

Nav-tide is, then, given as a difference of these two speed vectors.

Absolute Tide = 1 - 2



Tide Differential

Tide differential is a relative movement of tides at different depths, layer (A) and layer (B).

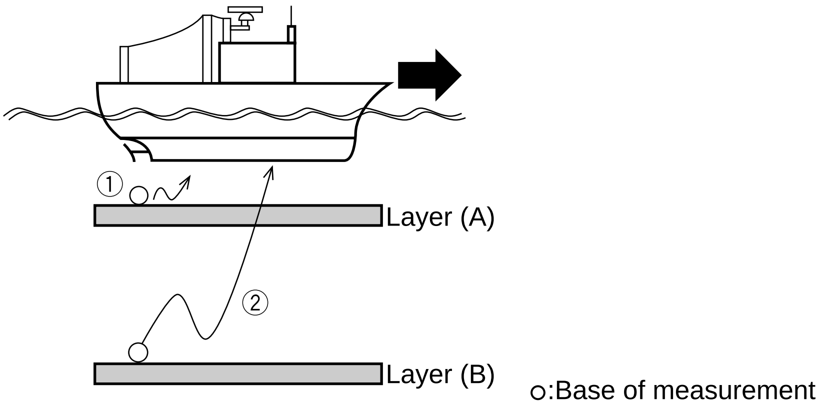
To calculate tide differential, the following two data are used:

1 Ship's speed and course based on layer (A)

2 Ship's speed and course based on layer (B)

Tide differential between two layers is, then, given as a difference of these two speed vectors.

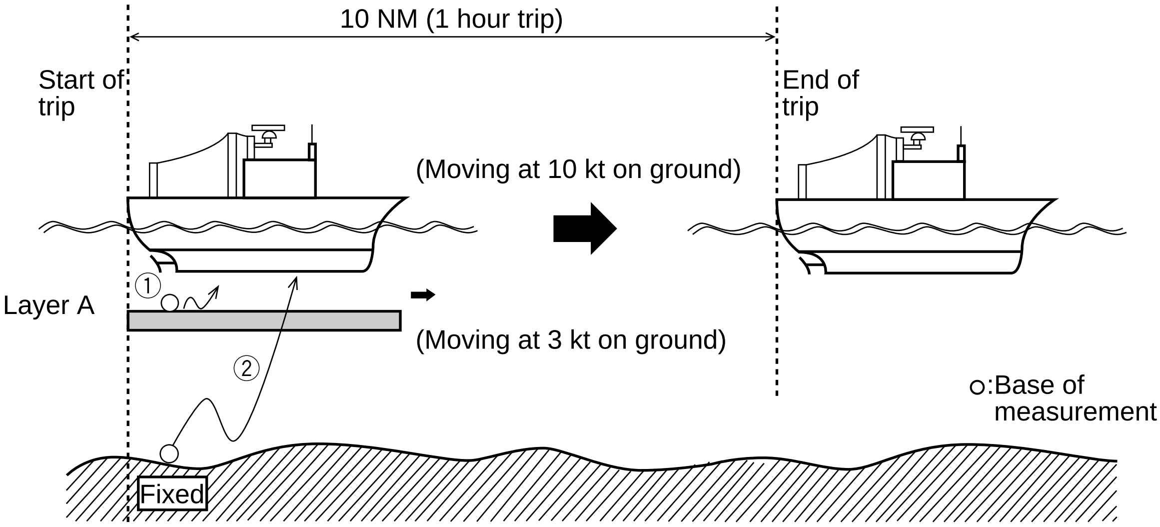
Tide Difference = 1 - 2 (Movement of layer B based on layer A)
or
= 2 - 1 (Movement of layer A based on layer B)



3. TIDE, NAV-TIDE & TIDE DIFFERENTIAL

Tide (Absolute tide)

Absolute tide can be measured in the ground tracking mode.



Assume that the ship and layer A are moving in the same direction, and ship's speeds based on ground (Vg) and on layer A (Vwa) are measured as;

Vg = 10 kt (Ship's speed based on ground)

Vwa = 7 kt (Ship's speed based on layer A).

Speed of layer A based on ground (C1) can be calculated as follows:

C1 = Vg - Vwa
= 10 - 7
= 3 (kt)

Nav-Tide (Absolute tide)

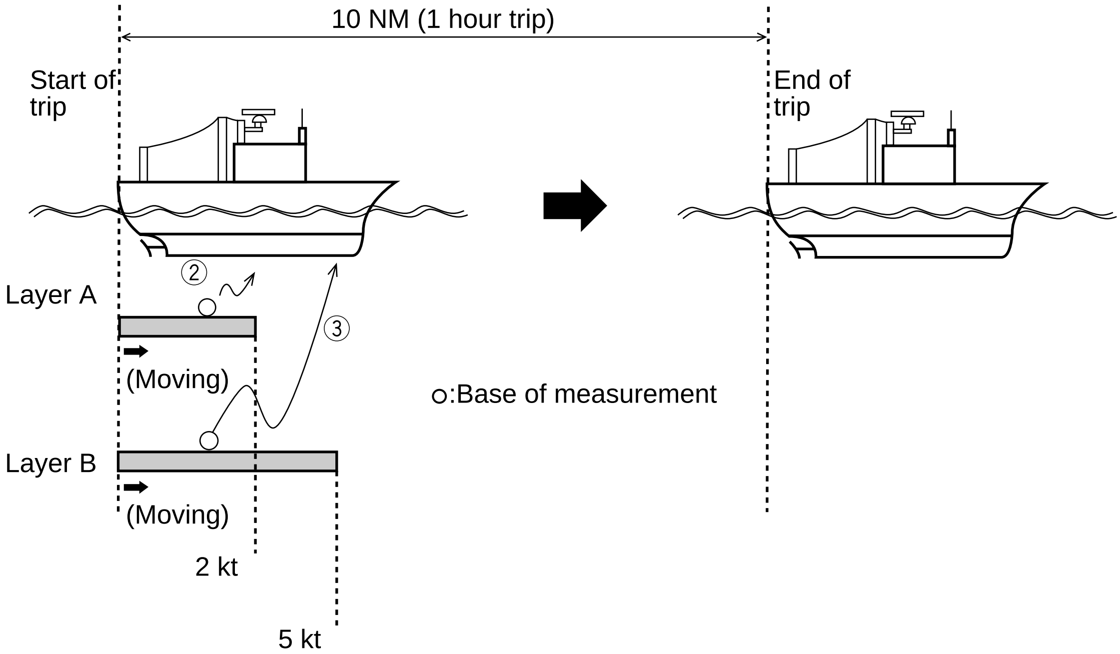
Absolute tide can be measured in the nav-aided mode.

Nav-aided ship's speed (Vn) is equivalent to ship's ground tracking speed in the ideal conditions. That is, the nav-tide can be calculated by simply replacing Vg with Vn in the above equation.

Tide Differential

Tide differential is a relative movement of tides at different depths.

It can be measured in the ground tracking, water tracking and nav-aided modes.



Assuming that the ship, layer A and layer B are moving in the same direction, and ship's speeds based on layer A (Vwa) and on layer B (Vwb) are measured as;

Vwa = 8 kt (Ship's speed based on layer A)

Vwb = 5 kt (Ship's speed based on layer B)

Tide differential calculations in ground tracking mode

As an absolute ship's speed (Vg) is available in the ground tracking mode, tide speeds of layer A (C1) and layer B (C2) based on ground are calculated as follows:

C1 = Vg - Vwa (Speed of layer A based on ground)

C2 = Vg - Vwb (Speed of layer B based on ground)

Thus, the tide differential (Cd) between layer A and layer B is;

Cd = C2 - C1
= (Vg - Vwb) - (Vg - Vwa)
= Vwa - Vwb
= 8 - 5
= 3 (kt)

Tide differential based on layer A (Speed of layer B viewed from layer A)

or

$$
\begin{aligned}
Cd &= C1 - C2 \\
&= (Vg - Vwa) - (Vg - Vwb) \\
&= Vwb - Vwa \\
&= 5 - 8 \\
&= -3 \text{ (kt)}
\end{aligned}
$$

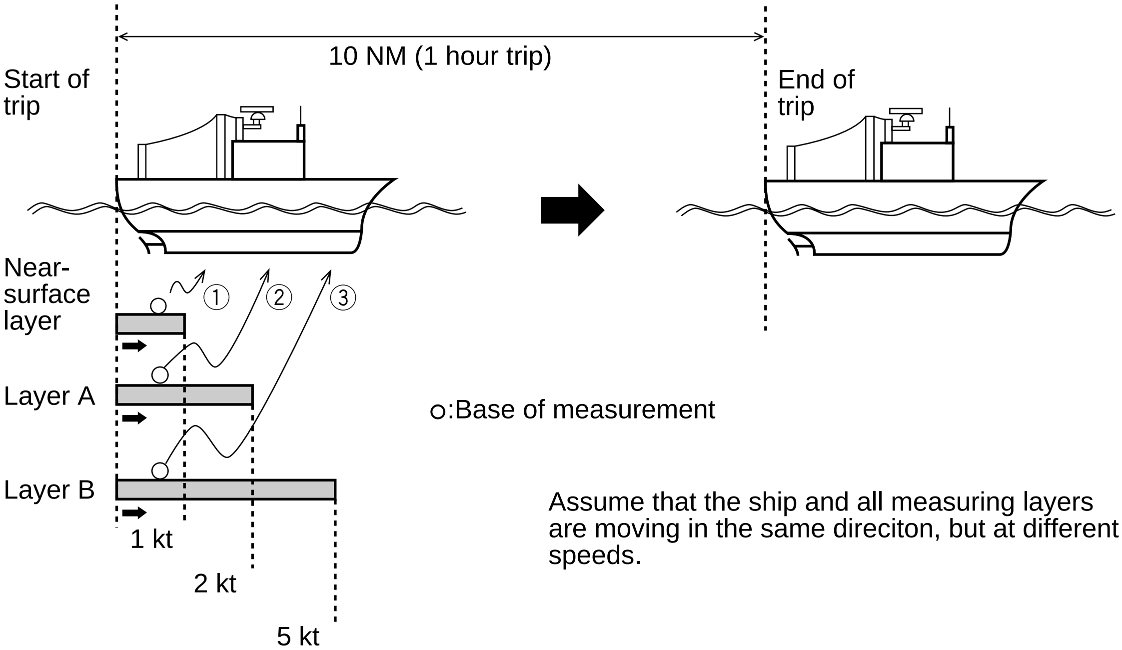
Tide differential based on layer B (Speed of layer A viewed from layer B)

In the water tracking mode, watermass just below the transducer (near-surface layer) is taken as the base of all measurements (virtual ground). Therefore, the ship and tide speeds in the water tracking mode are not absolute but relative to this near-surface layer.

Vw = 9 kt (Ship's speed based on near-surface layer)

Vwa = 8 kt (Ship's speed based on layer A)

Vwb = 5 kt (Ship's speed based on layer B)



Tide differential calculations in water tracking mode

Tide speeds of layer A (C1) and layer B (C2) relative to near-surface layer (Vw) are calculated as follows:

D1 = Vw - Vwa (Speed of layer A based on near-surface layer)

D2 = Vw - Vwb (Speed of layer B based on near-surface layer)

The tide differential (Dd) between layers A and layer B is;

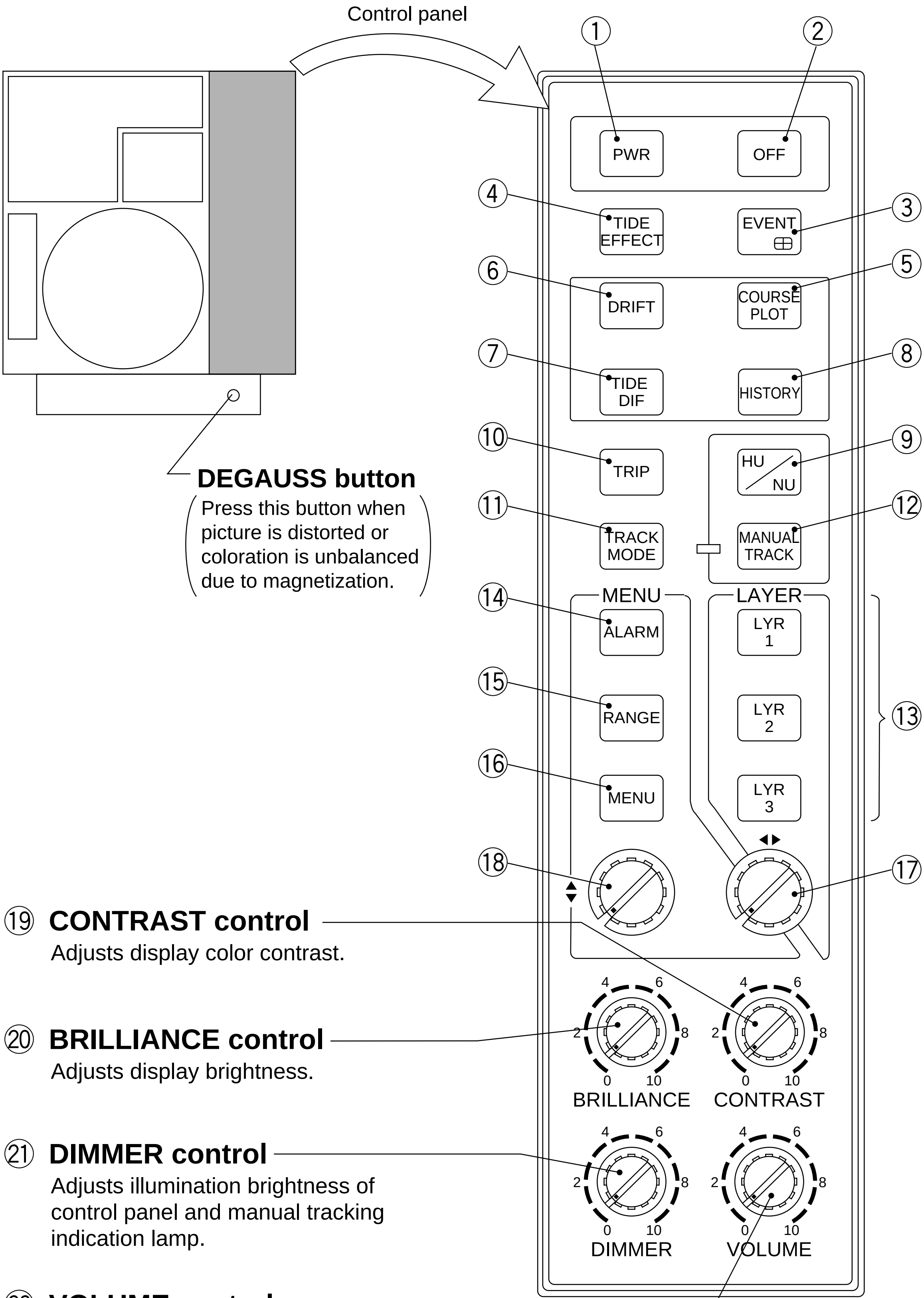
Dd	=	D2 - D1	Tide differential based on layer A (Speed of layer B viewed from layer A)
	=	(Vw - Vwb) - (Vw - Vwa)	
	=	Vwa - Vwb	
	=	8 - 5	
	=	3 (kt)	

or

Dd	=	D1 - D2	Tide differential based on layer B (Speed of layer A viewed from layer B)
	=	(Vw - Vwa) - (Vw - Vwb)	
	=	Vwa - Vwb	
	=	5 - 8	
	=	-3 (kt)	

If you compare the results of calculations on this page with the ones on preceding pages, you will find the tide differential of two layers is identical irrespective of tracking mode.

1. CONTROL PANEL LAYOUT



⑲ **CONTRAST control**
Adjusts display color contrast.

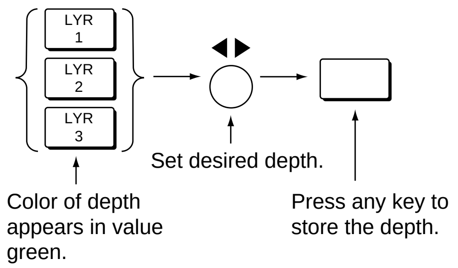
⑳ **BRILLIANCE control**
Adjusts display brightness.

㉑ **DIMMER control**
Adjusts illumination brightness of control panel and manual tracking indication lamp.

㉒ **VOLUME control**
Adjusts volume of key beep and audible alarm.

2. FUNCTION OF KEYS AND CONTROLS

KEY		FUNCTION/OPERATION	REMARKS
①	PWR	POWER ON : PWR	
②	OFF	POWER OFF: PWR + OFF	
③	EVENT	Plots event mark "+" at ship's present position. Event mark moves relatively as ship runs.	16 event marks maximum
		Functions as "ENTER" key or "EXECUTE" key when menu window is open.	
④	TIDE EFFECT	Starts tide effect plotting. (A cast mark "⬡" is plotted at the start point.) Tide effect plotting shows movements of layers beneath ship's course track. To stop plotting and to clear traces, press this key again. (Once cleared, previous traces can not be recalled.)	
⑤	COURCE PLOT	Switches on and off the course plot display. (Even while the plot display is off, positions are sampled internally, and ship's course made of last 200 sampled points is called up instantly.)	
⑥	DRIFT	Presents set/drift information at upper-right section of the display.	Alternative selection (⑥, ⑦)
⑦	TIDE DIF	Presents tide difference information at upper-right section of the display.	
⑧	HISTORY	Pressing this key presents a tide history of last 24 sample points. (Only the histories of active layers appear.) History display is automatically cleared upon completion of a presentation sequence.	Sampling time interval of tide history can be selected at MENU 1.
⑨	HU / NU	Switches presentation mode of vector/course plot display between north-up and head-up. Heading line (white broken radial) appears when north-up mode is selected.	North-up modes requires external heading data.
⑩	TRIP	Clears and starts trip time or trip distance count.	To select trip time or trip distance display, set alarm distance limit or time limit at the ALARM menu.
⑪	TRACK MODE	Changes tracking mode cyclically. MENU 4-WT SPEED: "T/D" → GT (*2) → WT (*1) → AUTO (*3) MENU 4-WT SPEED: "NAV-TIDE" → GT (*2) → NAV (*1) → AUTO (*3) *1: Select "T/D" or "NAV-TIDE" in MENU 4- "WT SPEED" to switch between "WT" and "NAV" mode. *2: "MAN" appears when tracking ground manually. *3: "EXT" appears when taking external depth data as reference.	

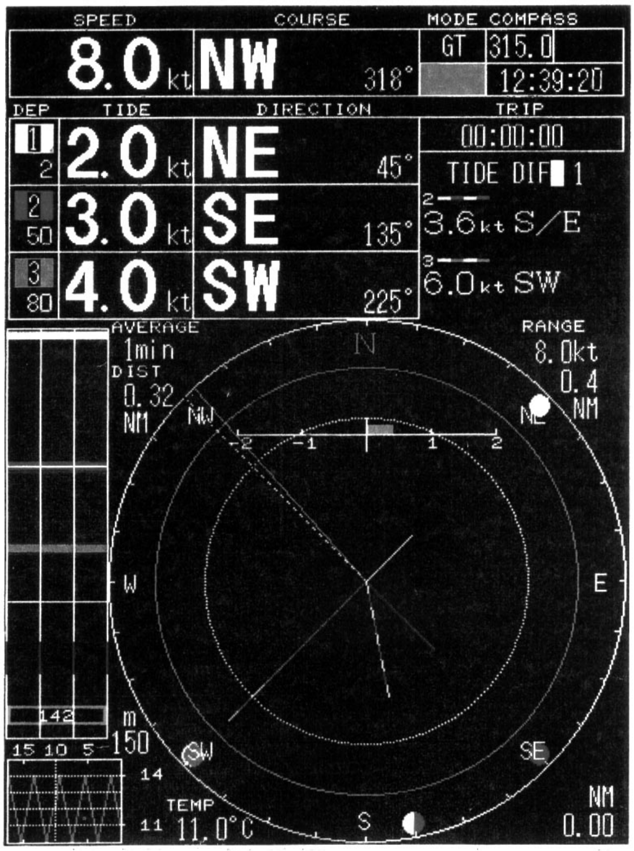
KEY		FUNCTION/OPERATION	REMARKS
⑫	MANUAL TRACK	Enables manual bottom acquisition in ground tracking mode. **PREPARATION** 1. In MENU 2, set “REF DEPTH” to “OFF.” 2. Select ground tracking mode. **MANUAL BOTTOM ACQUISITION** 3. Press and hold MANUAL TRACK key until LED lamp on the left of the key lights. (Mode display should change from “GT” to “MAN”.) 4. Turn ◀▶ knob to place manual acquisition cursor (▭) on the bottom echo in the echo level display. 5. Press MANUAL TRACK key again when bottom echo is acquired.	
⑬	LYR 1 LYR 2 LYR 3	Selects tide measuring depth for the layer.  **NOTE:** If “BTM TIDE TRK” is set to “ON” in MENU 3, the depth of layer 3 is automatically adjusted to near-bottom depth. (“BTM” appears instead of depth value.)	
⑭	ALARM	Calls ALARM menu to set alarm conditions for various items. ● Tide speed/direction ● Tide dif. speed/direction ● Ship speed/bearing ● Trip time/distance	See page 4-11.
⑮	RANGE	Calls RANGE menu to set range scales for various items. ● Vector speed range ● Course plot depth range ● Echo level depth range ● Echo strength gradation range	See page 4-10.
⑯	MENU	Calls basic MENU for various fundamental settings. (Sub-menus, MENU 1 thru MENU 4, are available.)	See page 4-1.
⑰	◀▶	● Sets value or specifies mode option for a selected item in menu window. (Related to keys ⑫ to ⑯.) ● Used to set ship’s heading manually, when external heading data is not available.	
⑱	▲▼	● Selects an item in a menu window. (Related to keys ⑭ to ⑯) ● Adjusts radius of range cursor (variable range marker) on the vector display. Distance to the ring appears at the upper-left part of the vector display.	

3. OPERATING PROCEDURE

	SUBJECT/PURPOSE	OPERATON (ACTION)
1	Power-on	● Press [PWR] key.
2	Display brilliance adjustment	● Turn BRILLIANCE control. (CW : Bright, CCW : Dark)
3	Setting measuring depth	● Press [LYR n] and turn ◀▶◯ knob to set depth. After setting, press any key.
4	Selecting tracking mode	● Tap [TRACK MODE] key to select tracking mode. GT/WT/AUTO or GT/NAV/AUTO. *Use ground tracking mode if water depth is shallower than 200m. *Select "T/D" or "NAV-TIDE" in MENU 4 - "WT SPEED" to switch between WT and NAV mode.
5	Reacquiring of temporarily lost ground echo (Manual bottom acquisition)	● Press and hold [MANUAL TRACK] key until "MAN" appears instead of "GT". (LED to the left of this key lights.) ● While watching echo level display, turn ◀▶◯ knob to place acquisition cursor on the bottom echo. ● Press [MANUAL TRACK] key when bottom acquisition is completed.
6	Changing presentation mode for vector graph display	● Press [HU/NU] key to alternate "Head-up" mode and "North-up" mode.
7	Setting ranges ● Speed range for tide vector display ● Distance range for course plot display ● Depth range for echo level display ● Color gradation level for echo level display	● Press [RANGE] key to call range menu. ● Set desired range by ▲▼◯ and ◀▶◯ knobs. ● Press [RANGE] key again to store the setting.
8	Setting conditions for measurements and displays	● Press [MENU] key. ● Set desired condition by ▲▼◯ / ◀▶◯ knobs and [EVENT] key. ● Press [MENU] key again to store the settings.
9	Setting alarm limits ● Ships speed/course ● Tide speed/direction ● Tide dif. speed/direction ● Trip time/distance	● Press [ALARM] key to call alarm menu. ● Set desired alarm conditions by ▲▼◯ / ◀▶◯ knobs and [EVENT] key. ● Press [ALARM] key again to store the settings.
10	Plotting event mark (Storing present position)	● Press [EVENT] key.
11	Starting and stopping tide effect plotting	● Press [TIDE EFFECT] key.
12	Switching course plot display on and off	● Press [COURSE PLOT] key.
13	Power-off	● While pressing and holding down [PWR] key, press [OFF] key.

1. DISPLAY SAMPLES

Sample 1



Ground Tracking Mode
(Ground echo available: GRN)

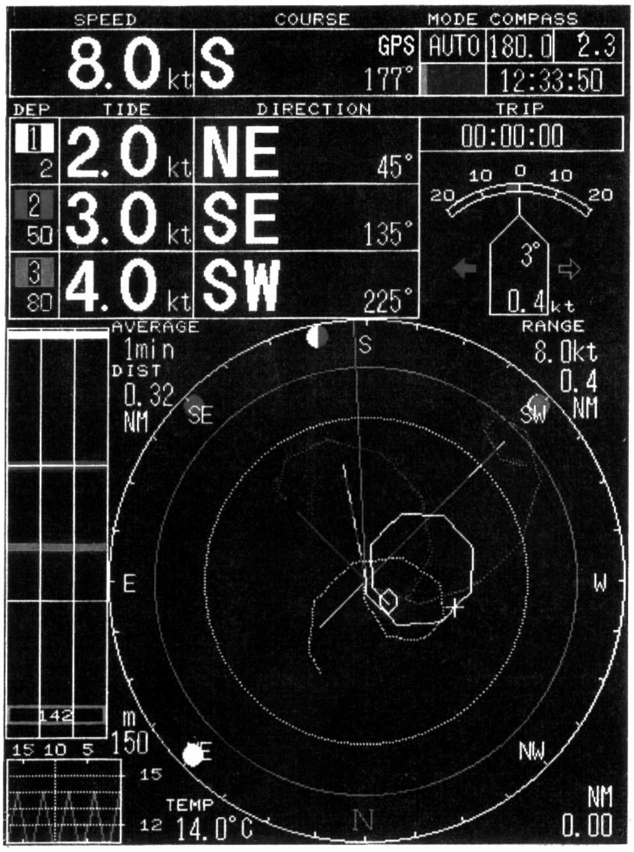
Tide Differential Display
(Based on layer 1)

Tide Vector Display
(North-up mode)

Ship's speed vector: GRN
Layer 1 tide vector: YEL
Layer 2 tide vector: PPL
Layer 1 tide vector: L-BLU
Tide dif. vector (1 → 2): YEL/PPL
Tide dif. vector (1 → 3): YEL/L-BLU

Fixed Range Ring (s): WHT ring
Range Cursor (VRM): GRN ring

Sample 2



Auto-Tracking Mode
Ground tracking : GRN
Nav-aided (GPS): BLU

Drift Display
Set : Deviation of true course from ship's heading
Drift : Lateral speed

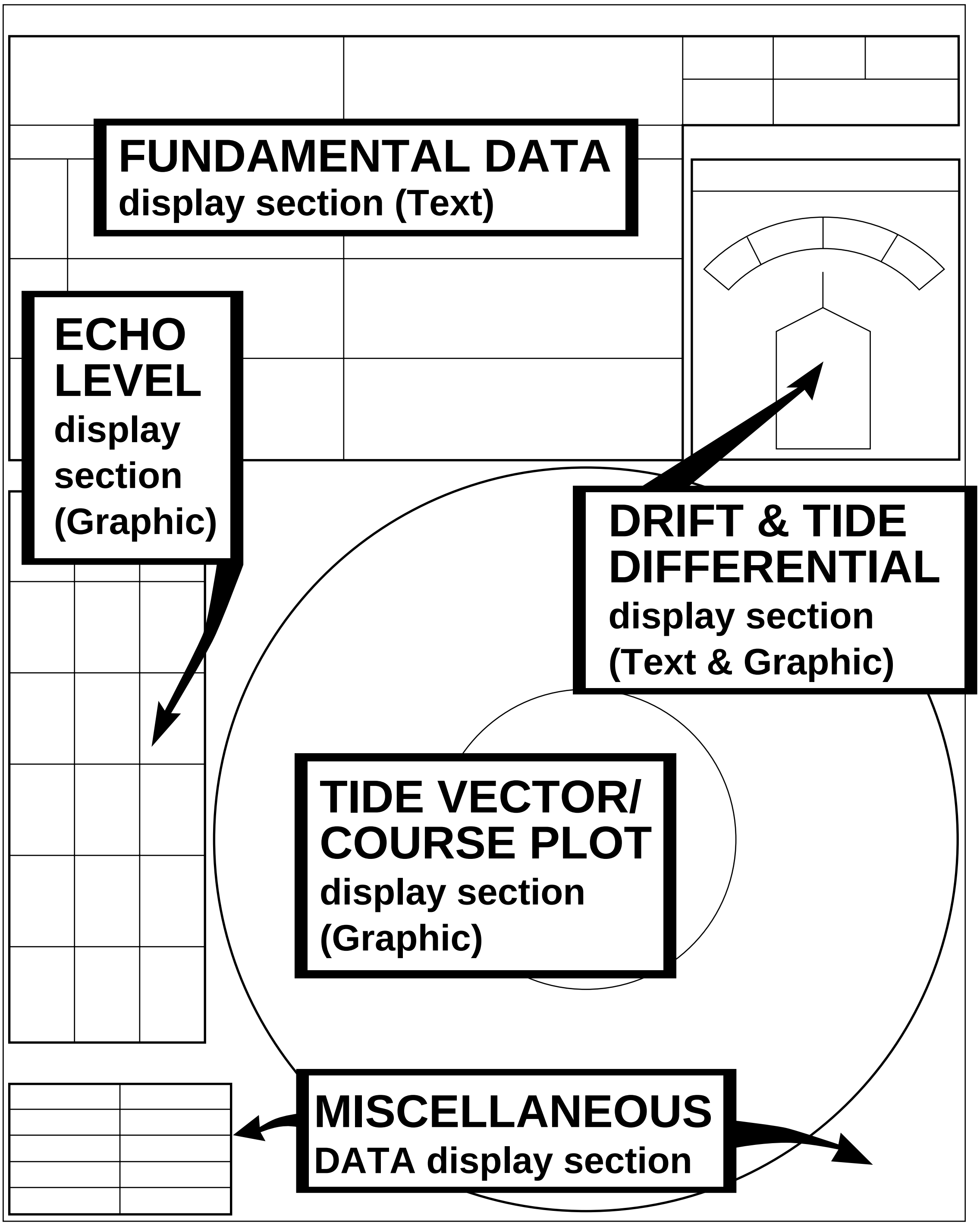
Tide Vector/Course Plot/Tide Effect Display (Head-up mode)

Ship's course track:
WHT line
Tide effect traces:
Colored dotted lines

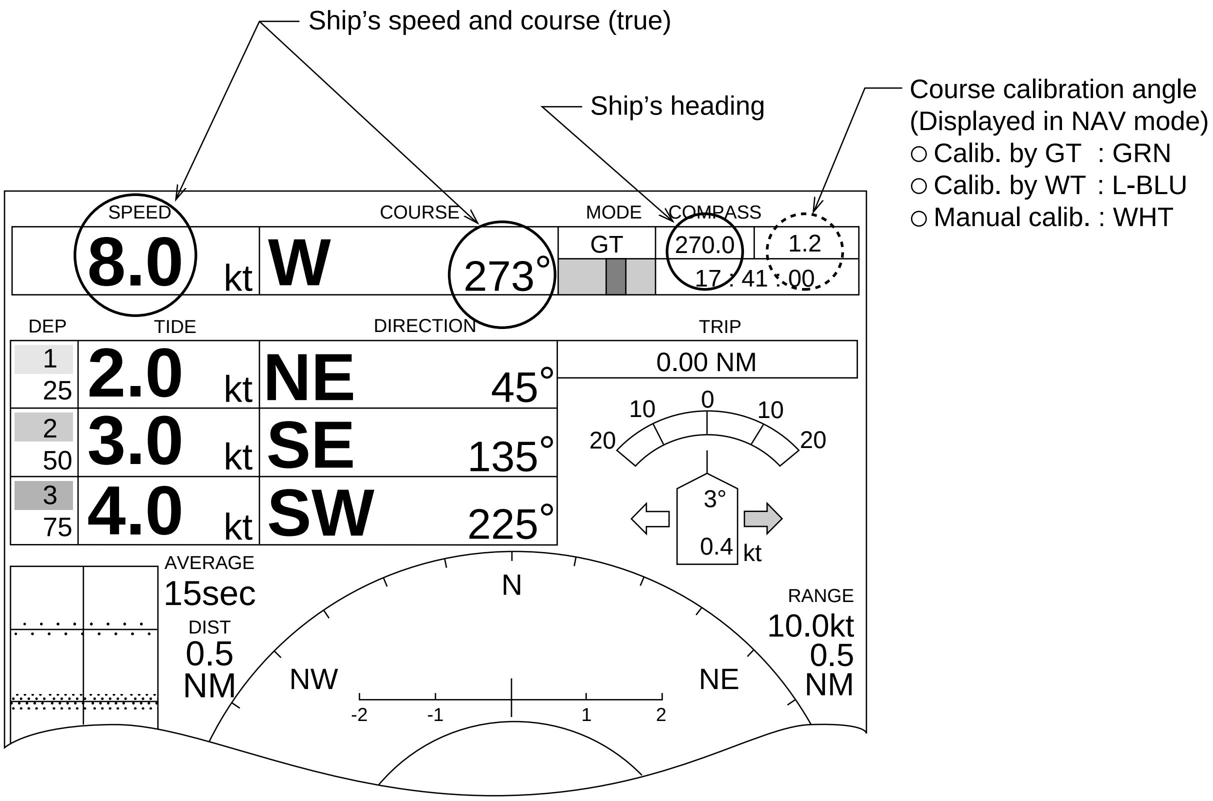
Event mark (+)
Cast mark (⬡) * Start of tide effect plotting

2. HOW TO READ THE DISPLAY

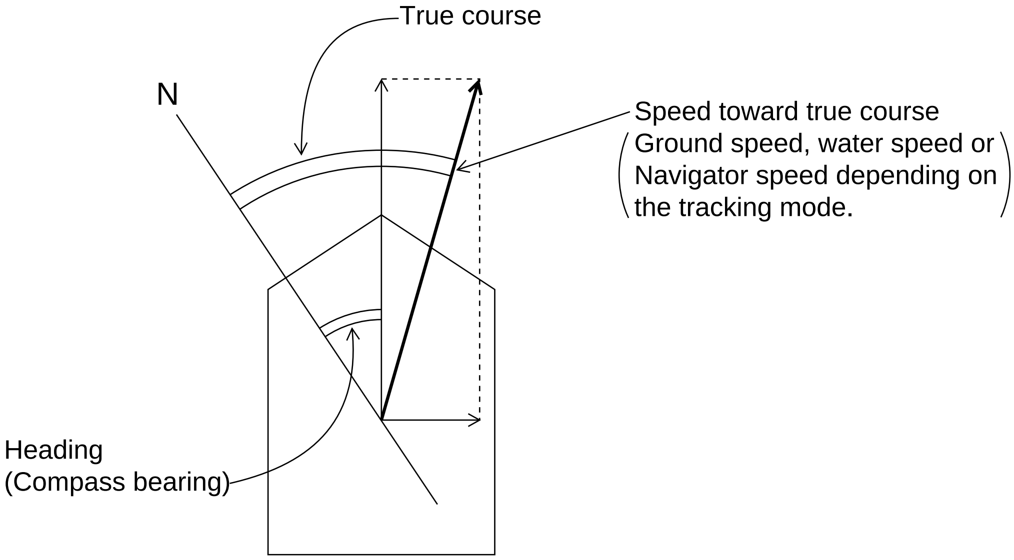
The display screen of the CI-35/35H is roughly divided into five sections as shown below. What is displayed in each section and how to use it is described on the following pages.



SHIP'S SPEED/COURSE Display

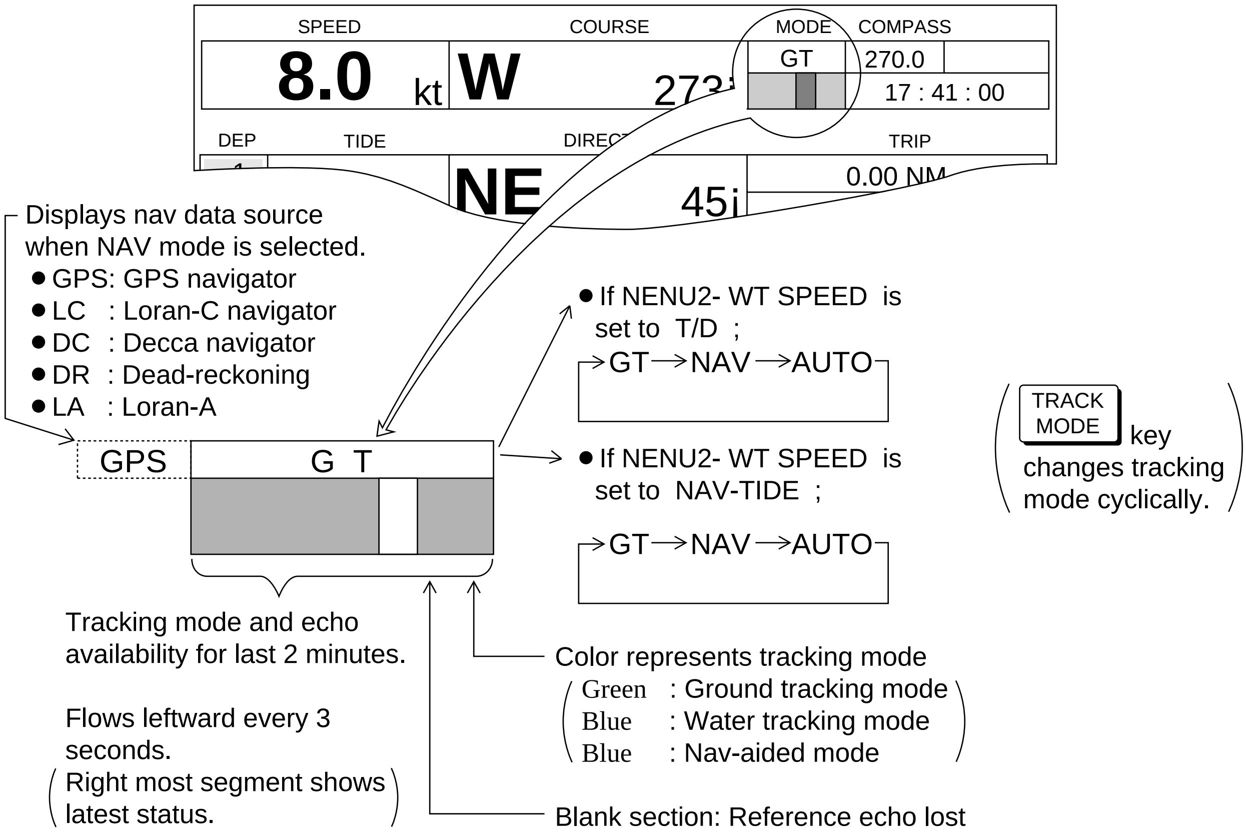


Note: The CI-35/35H updates ship's speed and course display in every 3 seconds with an averaging time selected in MENU 1. (See page 3-5 for averaging time setting.)



The course display appears in degrees and 32-point notation. If desired their locations can be swapped by changing the setting of an internal DIP switch. (See installation manual.)

TRACKING MODE Display



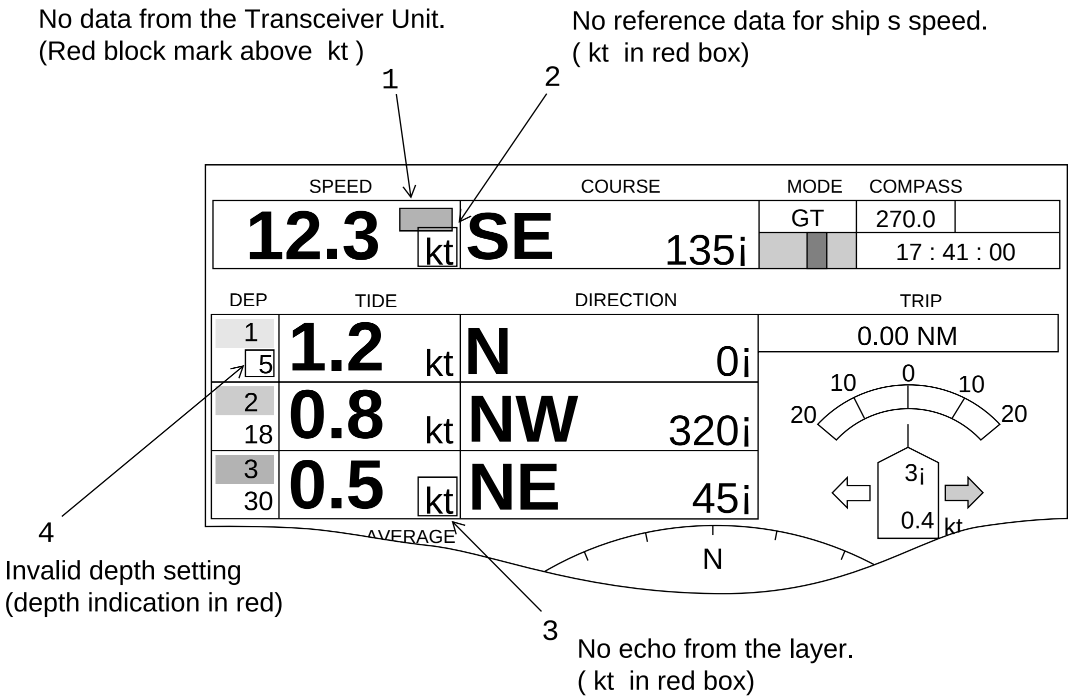
- **Ground Tracking Mode (*1)** : Shows absolute ship and tide movements based on ground. (Bottom echo required.)
- **Water Tracking Mode** : Shows movements of ship and tide relative to near-surface water.
- **Nav-aided Mode** : Shows ship's movement measured by the external navigation equipment, and the tide movements based on the nav speed data.
- **Auto Tracking Mode (*2)** : Uses ground tracking mode when bottom echo is available. Switches to water tracking mode (or nav-aided mode) when bottom echo is lost. Bottom echo is continuously searched for, and if re-acquired the ground tracking mode is restored.

(*1) Manual bottom acquisition is possible to disable unexpected bottom search when bottom echo is interrupted for a short period by air bubbles, or to avoid tracking on bottom fish. (See page 2-2 to enable manual ground tracking.)

(*2) For efficient and reliable bottom search in the auto tracking mode, depth data from an echo sounder can be used as a reference. In this case, "EXT" appears as a tracking mode identifier. (See page 4-4 to enable external depth input.)

ERROR Status display

When a source data for calculation and display seems to be abnormal, the following error indication appears on the display. This is to alert the operator not to rely on the related data.



1 If data is not received from the Transceiver Unit, a red square mark appears above “kt” in the SPEED display frame. As display data are not updated, do not rely on any data.

2 If the reference data for ship’s speed measurement is missing, the “kt” in the SPEED frame is enclosed in a red box. That is, no ground echo in the ground tracking mode, no reference water echo in the water tracking mode or no speed (position) data in the nav-aided mode. Do not rely on the ship’s speed/course and all tide speed/direction display.

3 If echo from a particular layer is too weak the unit denotes it by circumscribing “kt” in the TIDE frame in red. Do not rely on the tide speed/direction of the layer.

4 If an invalid measuring depth (*) is set, the depth value for the layer appears in red.

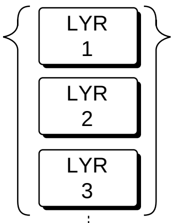
(*) Measuring depth of shallower than 13 meters or deeper than 3/4 of seabed depth is regarded as invalid depths.

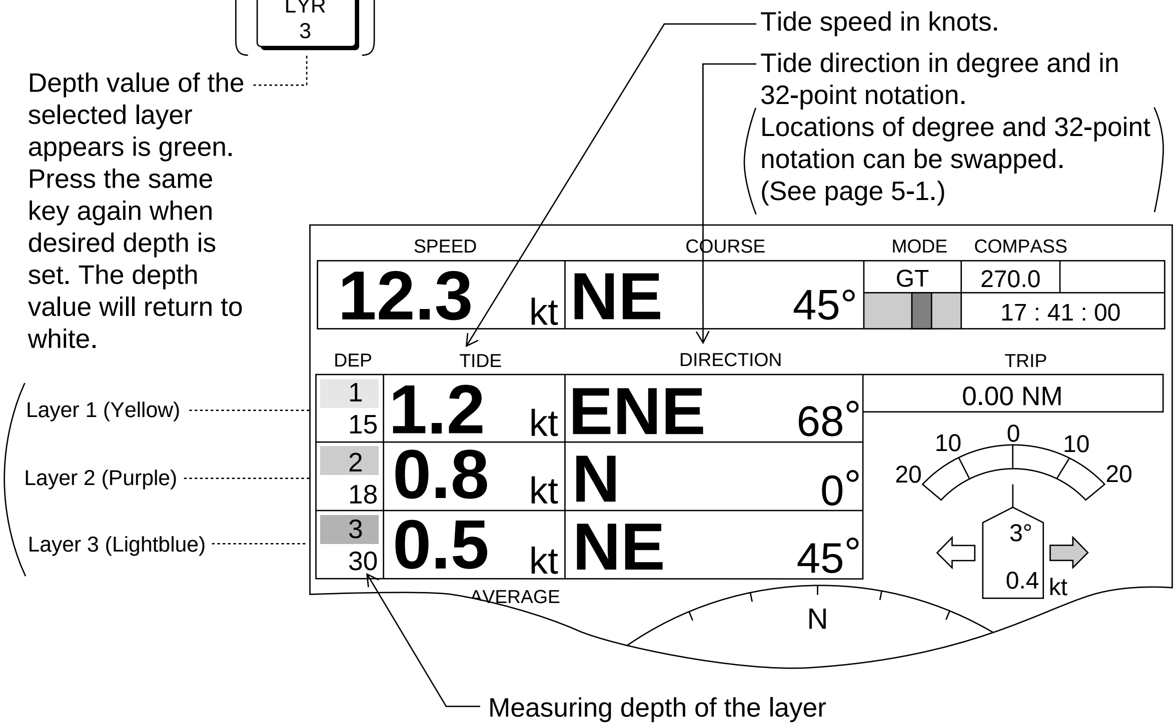
TIDE SPEED/DIRECTION Display (text)

Tide speeds/directions of three layers are displayed below the ship's speed/course.
Depending on the tracking mode in use, the meaning of speed/direction changes as follows

- In the ground tracking mode, speed/direction values represent movement of the layer relative to ground. [Ground-based tide = Absolute tide]
- In the water tracking mode, speed/direction values represent movement of the layer relative to near-surface water. Strictly speaking, they do not represent tide but tide differential. [Surface-based tide = Relative tide]
- In the nav-aided mode, speed/direction values represent movement of the layer relative to pseudo ground. [Ground-based tide = Absolute tide]
  (Note that accurate ship's speed/course and heading information must be applied to CI-35/35H to obtain reliable tide data.)

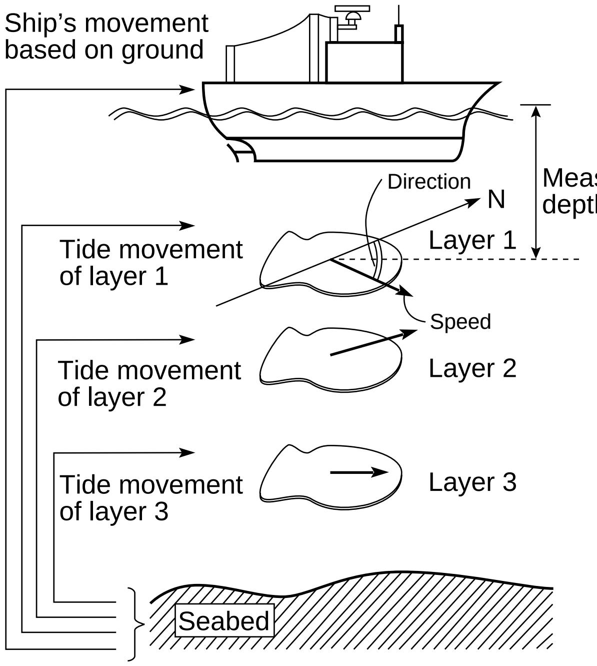
To set measuring depth of tide;

Select layer by  key, and turn ◀▶ knob to see desired depth.

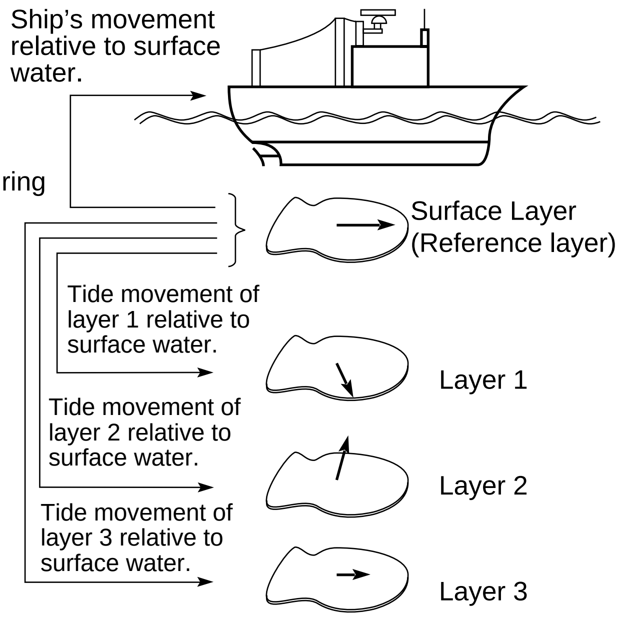


Note: Tide speed/direction display is updated every 3 seconds. The display is not raw data for every 3 seconds, but averaged for specified averaging time. (See page 4-2 to set averaging time for tide display.)

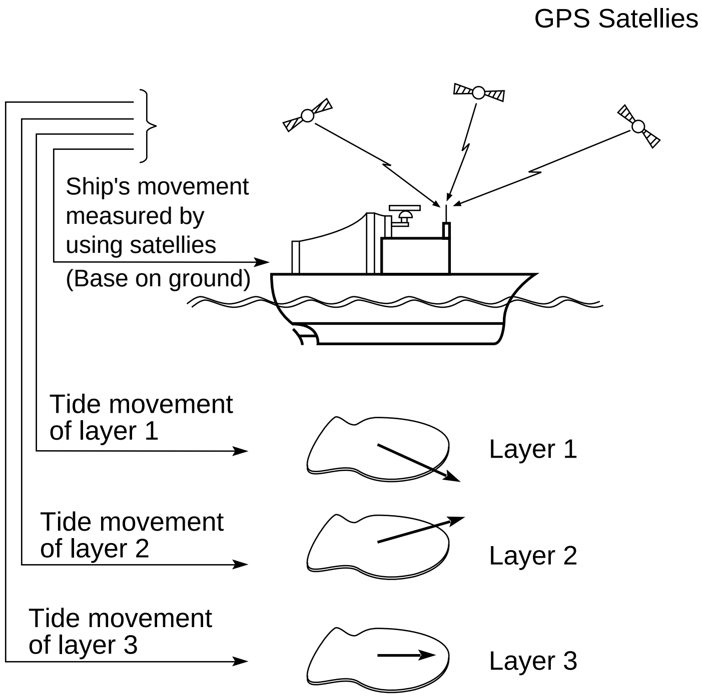
Ground Tracking Mode



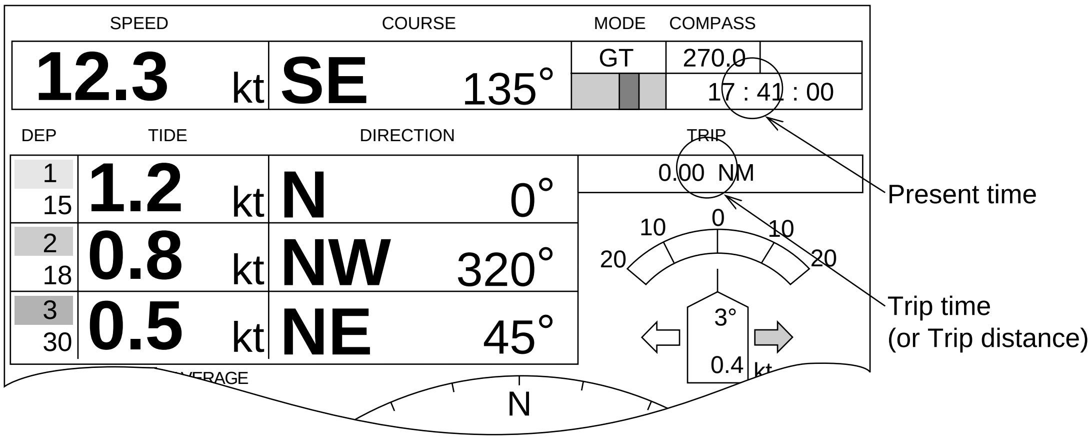
Water Tracking Mode



Nav-aided Mode



PRESENT TIME Display



- Refer to page 4-4 to set date/time of the internal clock. (MENU 2 - “DATE/TIME”)
- It is possible to display time data received from the external navigation equipment, instead of the internal clock. However, the time display may not increment every one second since the time update depends on the incoming data interval. Refer to page 4-8 to use the external clock. (Set MENU 4 - “TIME DATA” to “EXT”.)
- Date is not displayed in the standard screen, but on top line in the MENU window.

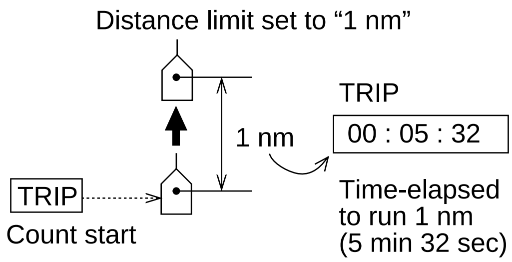
TRIP TIME/DISTANCE Display

The TRIP function is used to measure distance-run in a certain time or time-elapsed to run a certain distance. It is also possible to cause audible and visible alarm when a certain time limit or distance limit is reached.

To set time limit or distance limit, call ALARM menu by the ALARM key and enter desired values in the “TRIP” option. (See page 4-15.)
Note that the time limit setting provides trip distance on the TRIP window, and the distance limit setting provides trip time display. (Time and distance are interlocked.)

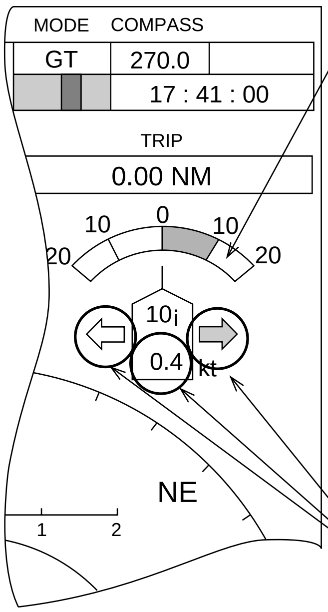
To start trip count, press the TRIP key.
The count increments as vessel moves or as time elapses.

When time limit or distance limit is reached, counting is stopped, the distance or time count in the TRIP window turns red, and the audible alarm, if enabled, sounds.

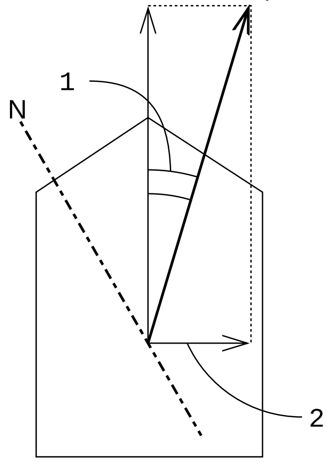


SET & DRIFT Display

Press the DRIFT key to call the set and drift display.



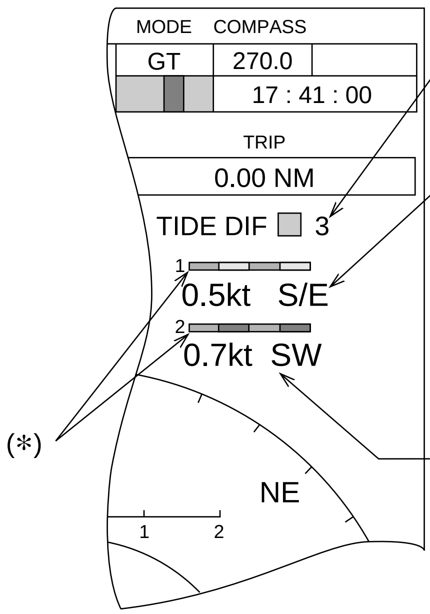
1Set angle (Leeway angle)
(20¡ port to 20¡ starboard)
Deviation of true course from ship s heading.



2Drift speed (lateral speed)
(9.9 kt port to 9.9 kt starboard)
Filled arrow shows drifting direction.

TIDE DIFFERENTIAL Display

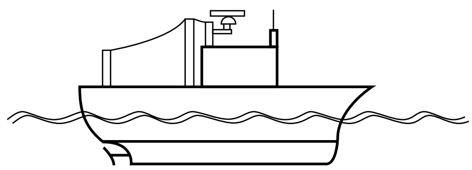
Press the TIDE DIF key to call the tide differential display.



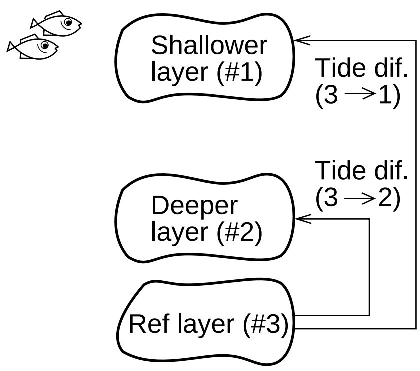
1Reference layer number
See page 3-3 to set reference layer.

2Tide differential between reference layer and shallower of the other two layers.

3Tide differential between reference layer and deeper of the other two layers.



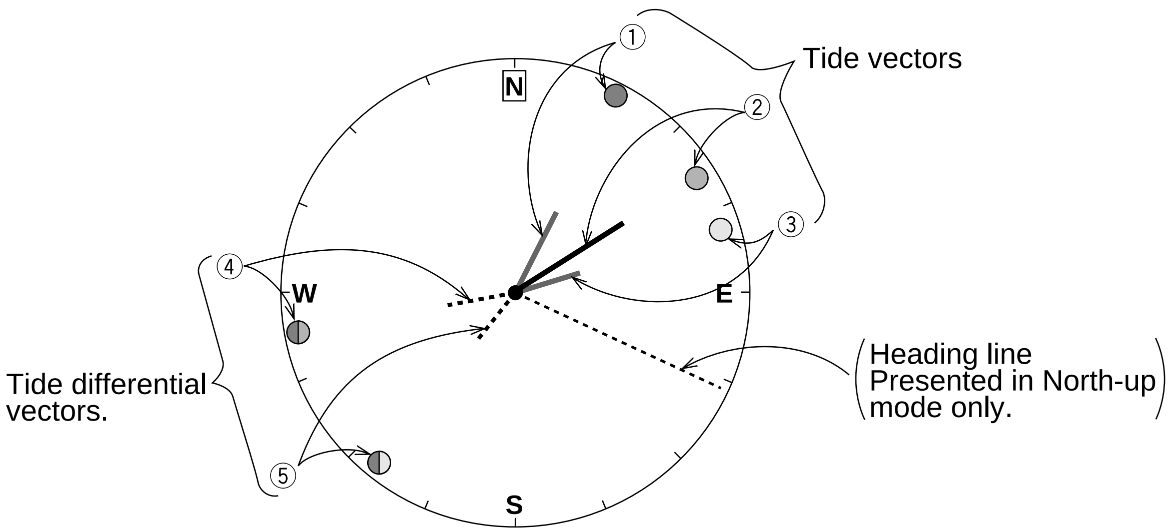
(Ex.) Ref layer = #3



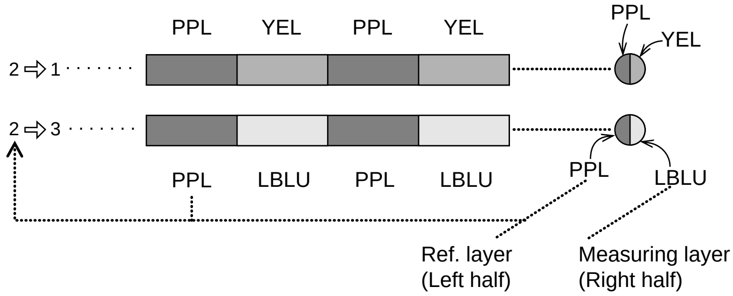
(*) Colors in bar correspond to layers used for tide differential measurement.

TIDE VECTOR Display

- Each tide vector can be switched on and off independently by MENU 1 - “LAYER n” setting. (Refer to page 4-2.)
- Tide differential vectors can be switched on and off by MENU 1 - “TIDE DIF DISP” setting. (Refer to page 4-2.)
- Each vector bar indicates “flowing to” own ship direction with the standard factory setting. It is possible to reverse the pointing direction to “flowing from.”



Note: If vector bars of two or more layers point in the same direction, only the vector bar and the direction mark of the shallowest layer appear.

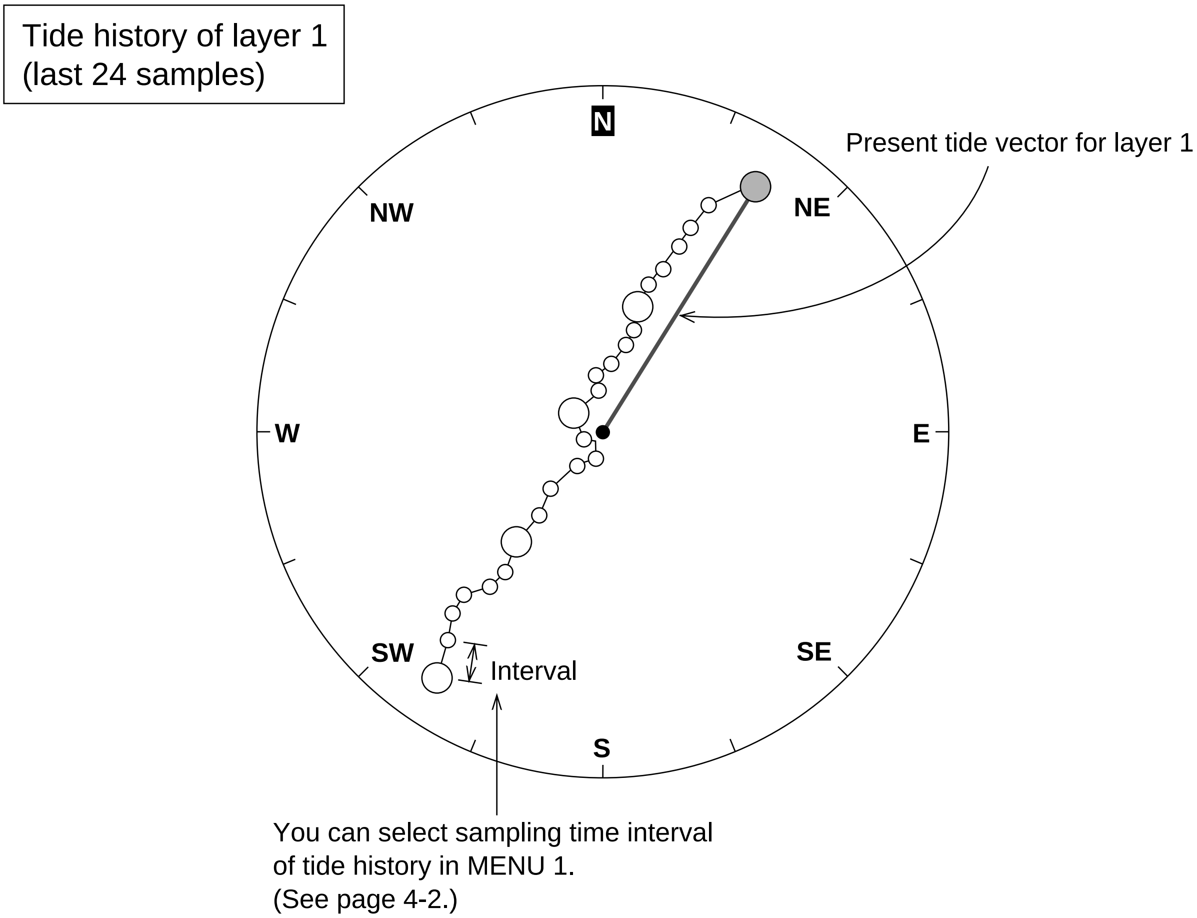
	Ground Tracking Mode (See page 3-6)	Water Tracking Mode (See page 3-6)	Nav-aided Mode (See page 3-6)
① (YEL)	Absolute tide movement of layer 1	Relative tide movement of layer 1 based on surface layer.	Absolute tide movement of layer 1 (nav-tide)
② (PPL)	Absolute tide movement of layer 2	Relative tide movement of layer 2 based on surface layer.	Absolute tide movement of layer 2 (nav-tide)
③ (L-BLU)	Absolute tide movement of layer 3	Relative tide movement of layer 3 based on surface layer.	Absolute tide movement of layer 3 (nav-tide)
④ ⑤	Tide differentials between a specified reference layer and the other two layers. (Ex. Ref. Layer = #2) 		

TIDE HISTORY Display

The CI-35/35H can hold last 24 tide samples collected at a time interval of 15 sec, 1 min, 5 min, 10 min, 30 min or 1 hour. The tide history presents variation of these tide information with a string of round marks. That is, distance from the graphic center to a mark represents tide speed at the sample time, and the direction from the center to a mark represents tide direction.

The figure below can be interpreted that the tide has changed from SW to NE (opposite) direction.

- To call the tide history display, press the HISTORY key. The tide history of layers activated in MENU 1 - "LAYER n" are displayed. (The figure below shows history of only one layer.)
- To restore normal tide vector display, press the HISTORY key again.

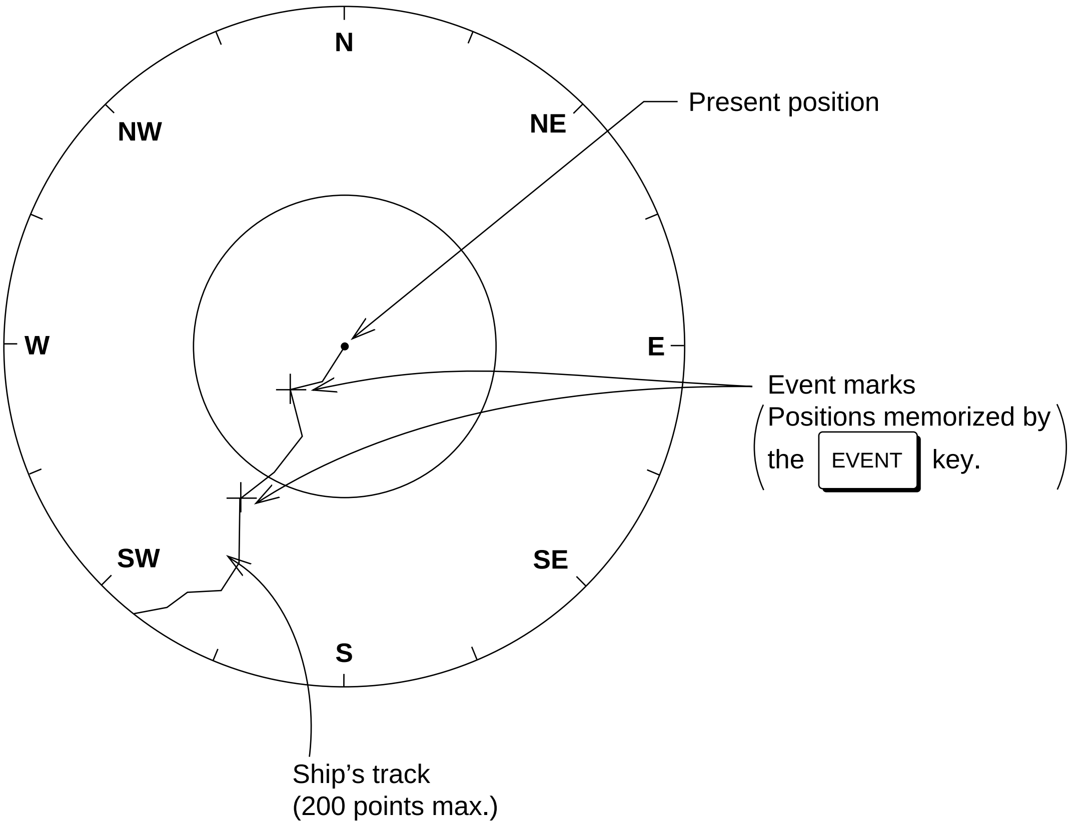


Note: The CI-35/35H preserves the tide history data stored in the memory when the power is off.

COURSE PLOT Display

The course plot display provides ship's track of last 20 minutes (200 points, one point sampled every 6 seconds). Event positions, stored by the EVENT key, are also plotted with "+" marks.

` Press the COURCE PLOT key to call course plot display, and press the same key again to restore previous display.



` To change display range (distance range) of course plot, press the RANGE key and set desired 'DIST RANGE' in the RANGE menu. (See page 4-10.)

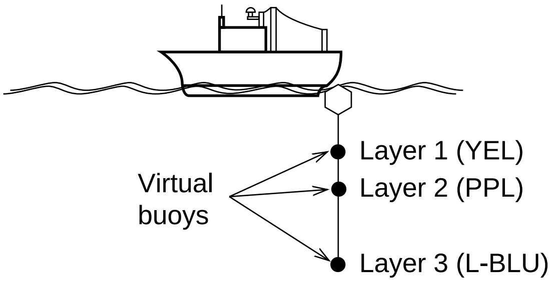
` To clear event memory (marks), select 'ERASE' in MENU 1 - "EVENT" and then press the EVENT key.

Note: ` Capacity of ship's position memory (for course plotting) is limited to 200 points. When the position memory is fully occupied, the oldest position is erased as new one comes in.
` Position memory will erased when the power is turned off.
` Sampling interval of ship's position is fixed to 6 seconds, and it can not be changed.

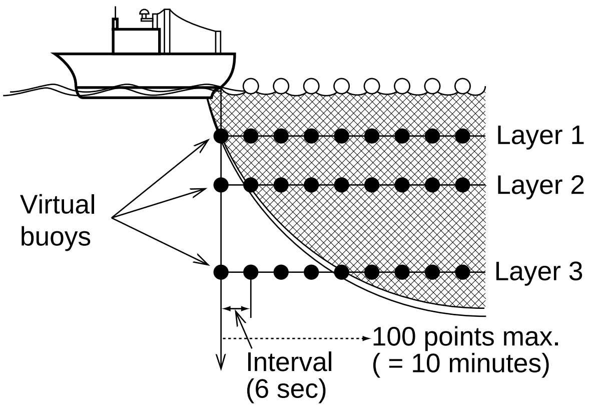
TIDE EFFECT Display

The tide effect display is useful for estimating three-dimensional deformation of cast net by the effect of tides at different depths. Notice that display merely shows movements of layers; it does not show true net shape in the water.

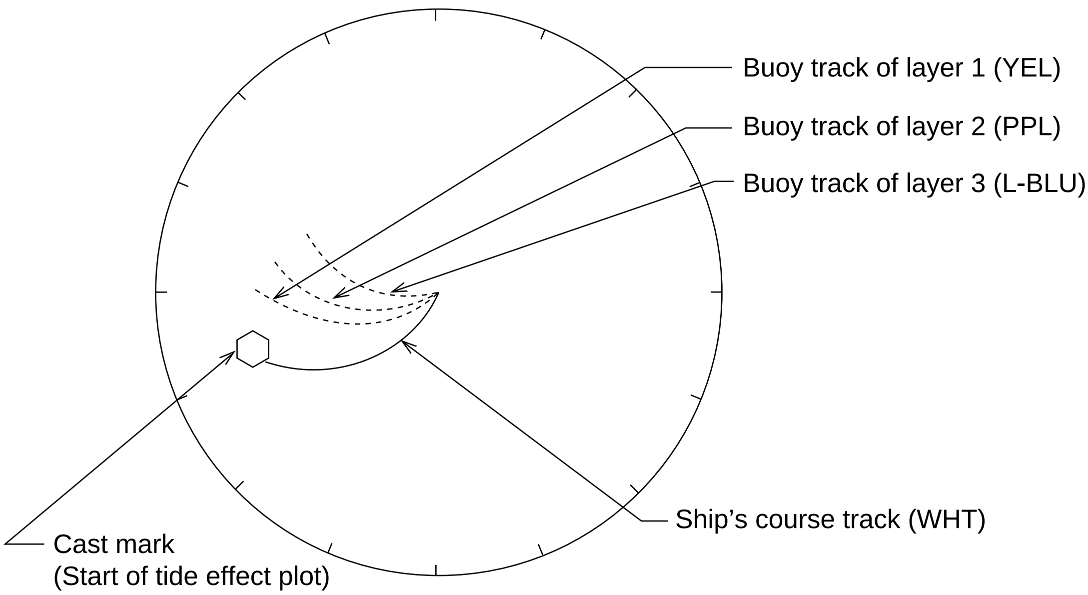
Assume that you put drifting marks (virtual buoys) on the net at each layer below the vessel at an interval of six seconds.



As the marks move with the tides keeping the same speeds and directions, a series of marks makes a brief section shape of the net at the layer.



In practice, a net does not sink immediately, because of various tensions and stresses placed on it. Thus, use the tide effect information only as a reference.

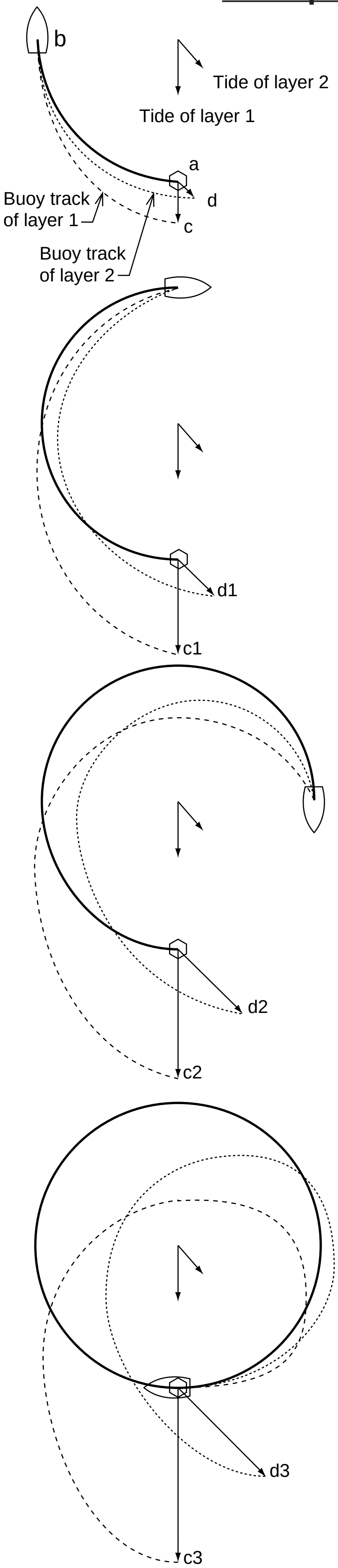


` To start "tide effect plotting", press the [TIDE EFFECT] key.

` To stop plotting and to clear traces, press the [TIDE EFFECT] key again.

Example of tide effect plotting

Display (Head-up)



Casting the first virtual buoys at point “a”, vessel made 1/4 of a circle and reached point “b”.

Assume that each buoy moves on each layer keeping the same speed and direction as at time of measurement.

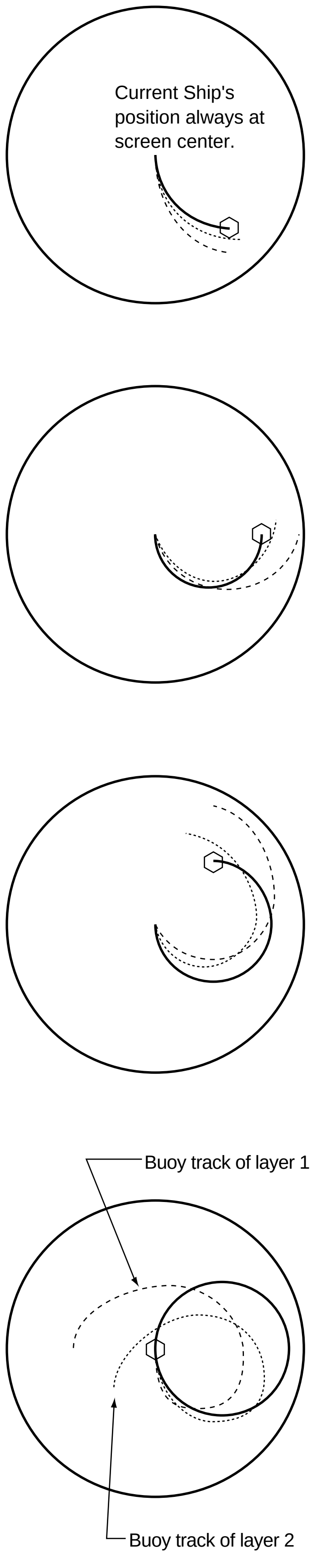
As time passes, the first buoys should move as lows:

- c → c1 → c2 → c3: (Layer 1)
- d → d1 → d2 → d3: (Layer 2)

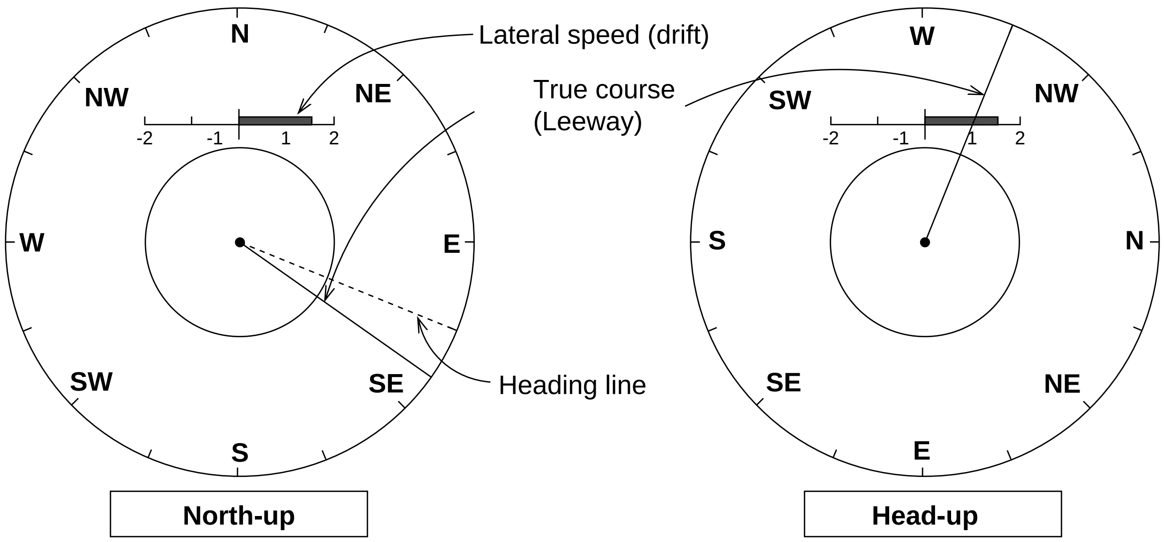
If the above situation is presented in the head-up mode, the display will change as shown right.

If there is no tidal movement, the ship’s course and the buoy tracks will coincide.

If all layers are moving at the same speed and direction, buoy tracks of all layers should coincide.

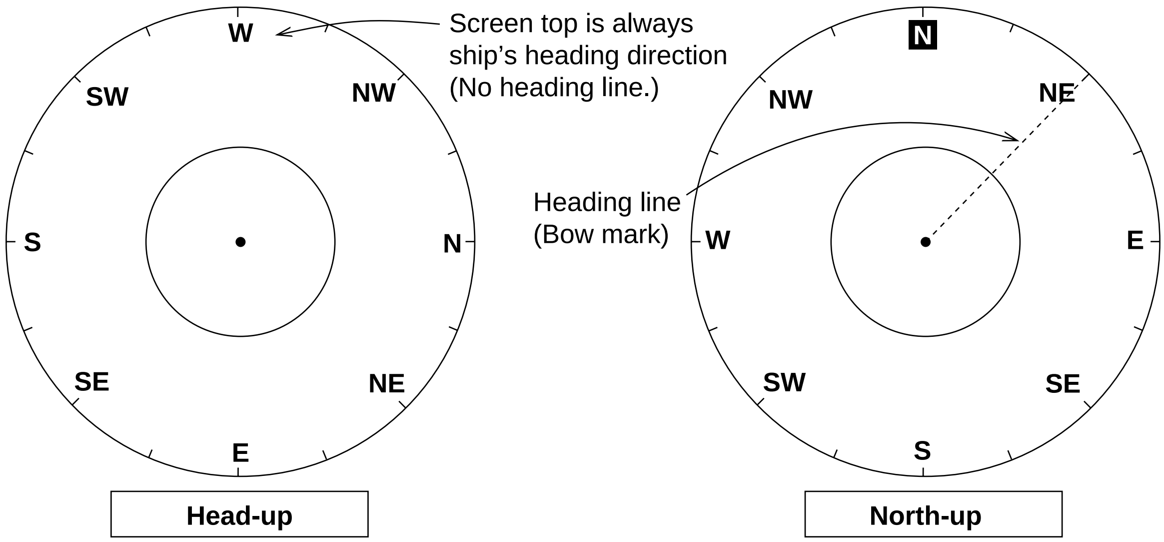


DRIFT Display (Switched on and off in MENU 1)

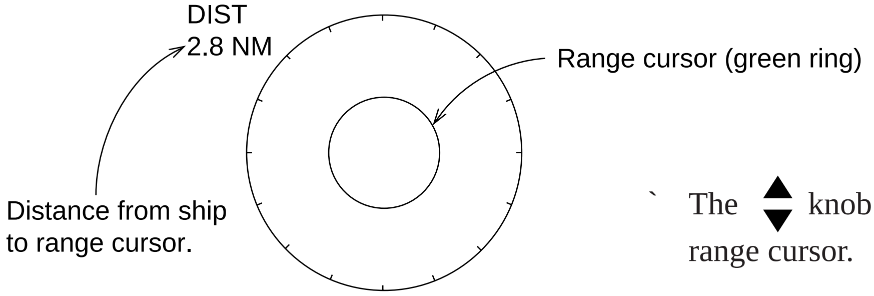


HEAD-UP/NORTH-UP Presentation

The HU/NU key switches between "HEAD-UP" mode and "NORTH-UP" mode.



RANGE CURSOR (Variable Range Marker)

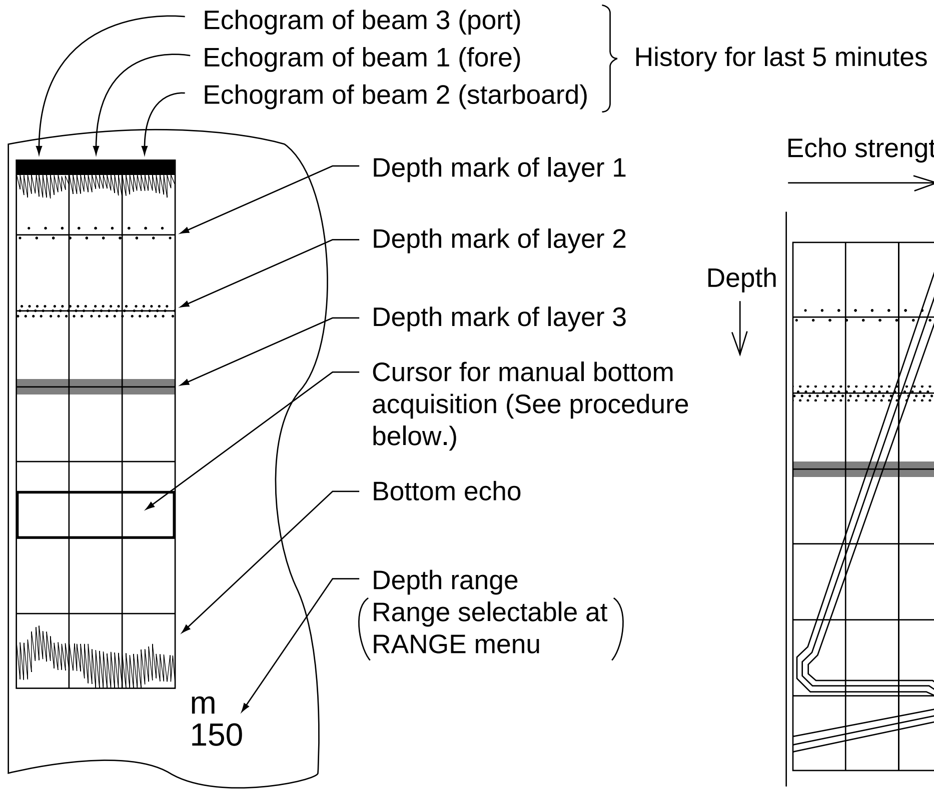


The ▲▼ knob adjusts the radius of the range cursor.

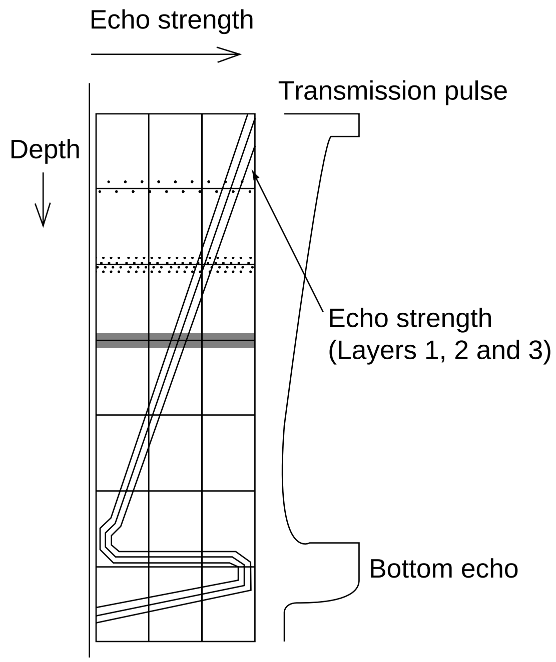
ECHO LEVEL Display (Display mode selectable in MENU 1)

Two presentation modes are available for echo level display.

- The "COLOR" mode provides narrow echograms for three directions, presenting echo strengths in color gradation. (Color sounder mode)
- The "GRAPH" mode presents echo strengths of three beams with amplitude varying with depth. (A-scope mode)



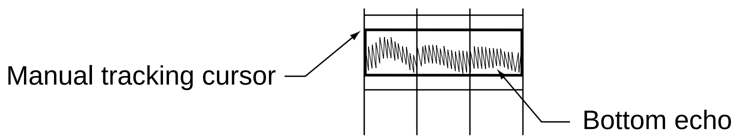
COLOR GRADATION mode
(Echo history for 5 minutes)



AMPLITUDE GRAPH mode
(Realtime A-scope)

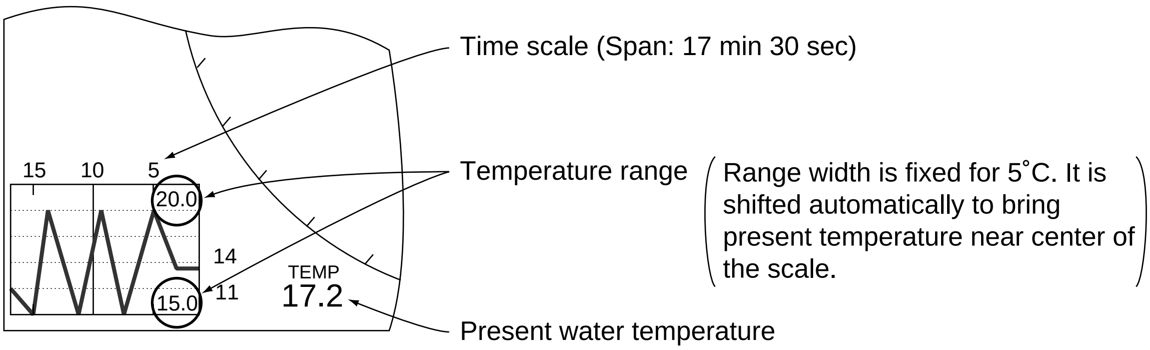
- When bottom echo is lost for a short while due to air bubbles, or the equipment tends to track on false bottom, try to acquire it manually.

1. Set "REF DEPTH" to OFF in MENU 2.
2. Select ground tracking mode by the [TRACK MODE] key.
3. Press the [MANUAL TRACK] key for more than 1 second. LED indicator aside the key lights and the manual tracking cursor appears in the echo level display.
4. Turn ◀▶ knob to place the cursor on the bottom echo.
5. When bottom echo is acquired, press the [MANUAL TRACK] key to return to the automatic ground tracking mode. (Do not leave the equipment in the manual tracking mode.)



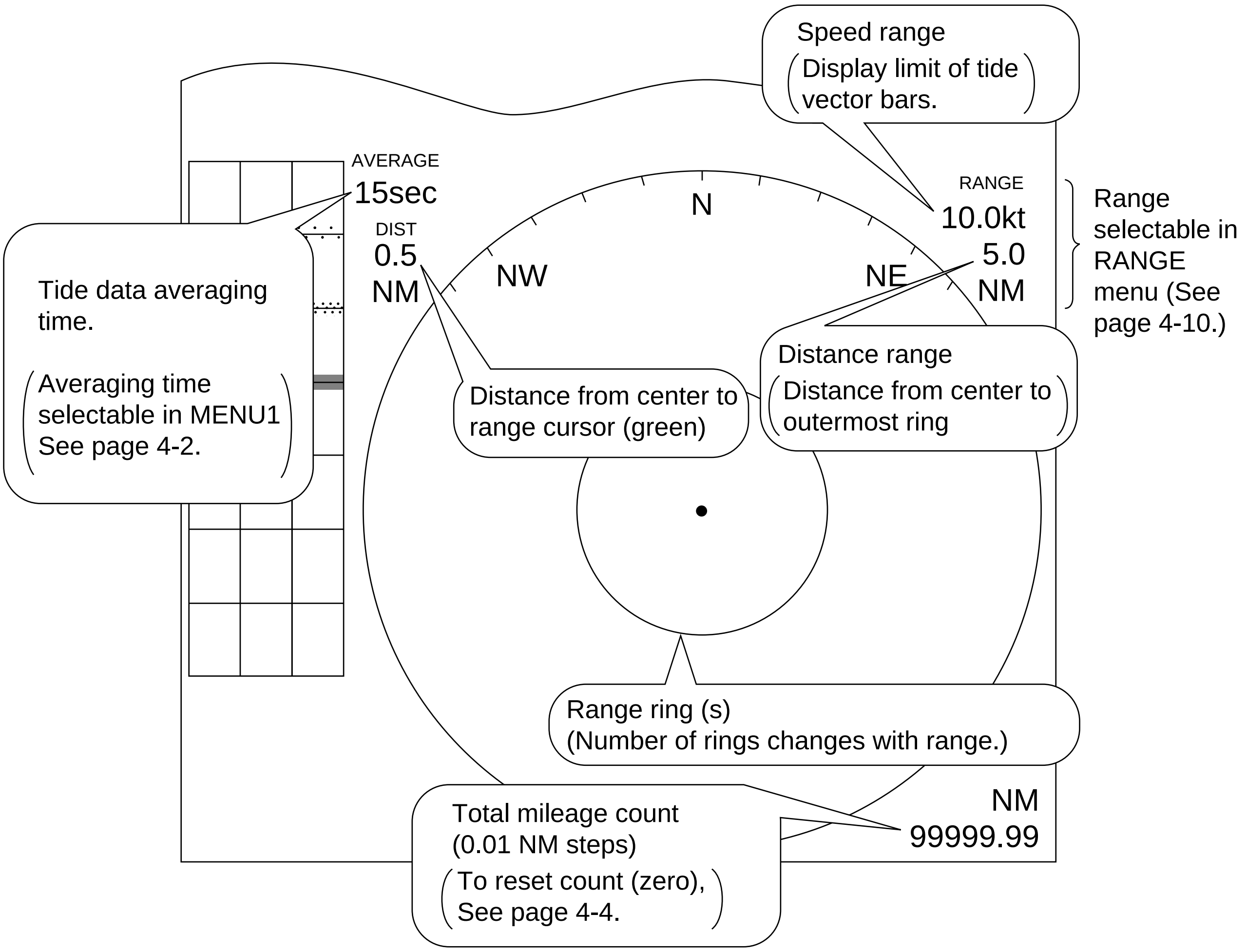
WATER TEMPERATURE Display
(Temperature data from external equipment required.)

` You can switch the temperature display on and off in MENU 1.



MISCELLANEOUS DATA Display
(Tide Averaging Time/Total Mileage/Display Range)

` You can change the unit of distance/range to km by an internal DIP switch. (Refer to installation manual.)



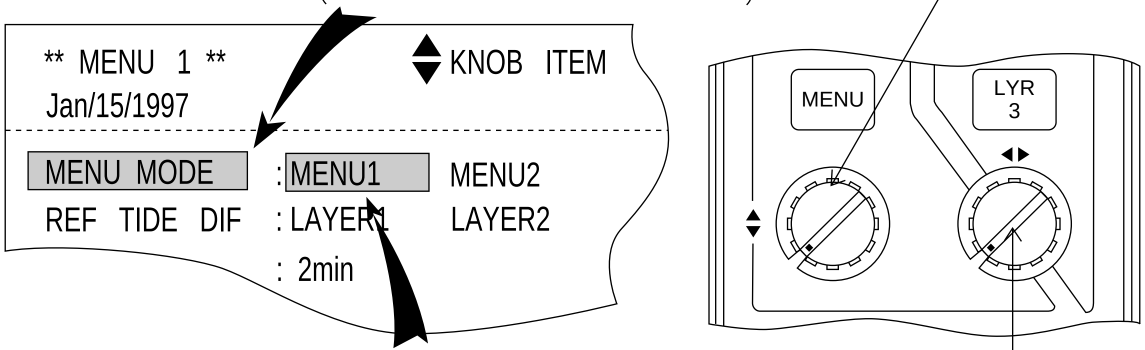
CHAPTER 4. SETTING OPERATING CONDITIONS

The CI-35/35H has three menus which you can preset various conditions for measurements and presentations; basic menu range menu and alarm menu.

General Rules for Menu Selection

■ Main item selection: Turn ▲▼ knob.

- CW to move cursor upward
- CCW to move cursor downward



■ Mode option selection: Turn ◀▶ Knob.

- CW to move cursor right
- CCW to move cursor left

■ Value setting: Turn ◀▶ Knob.

- CW to increment Value
- CCW to decrement value

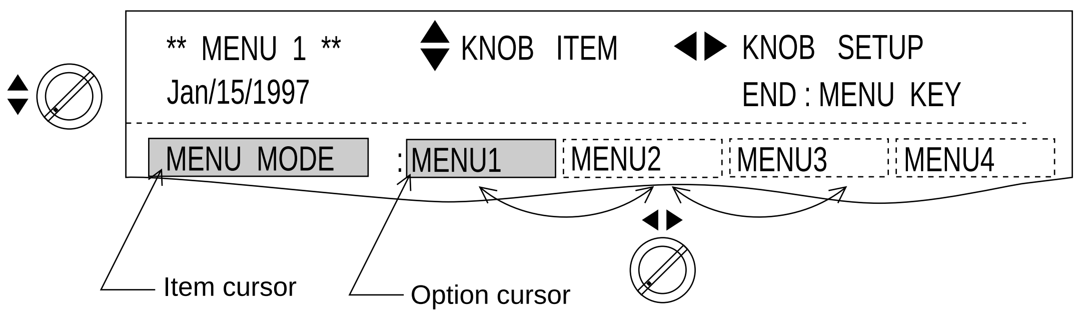
■ Validating settings and terminating menu: Press [MENU] key.

1. BASIC MENU

Pressing the [MENU] key calls the basic menu window on the display. The basic menu contains four pages of menus called "MENU 1", "MENU 2", "MENU 3" and "MENU 4".

Important items in the menus appear in red to show that they are "locked" (protected) to prevent accidental change of settings.

To select another menu page in the basic menu, place cursor on "MENU MODE" - 'MENU n' by using ▲▼ and ◀▶ knobs.



MENU 1

* MENU 1 *	▲▼ KNOB ITEM		◀▶ KNOB SETUP	
Jan/15/1997			END : MENU KEY	①
MENU MODE	: MENU1	MENU2	MENU3	MENU4
REF TIDE DIF	: LAYER1	LAYER2	LAYER3	②
(Note 1) TIDE AVERAGE	: 2 min			③
TIDE HISTORY	: 15 sec			④
(Note 2) LAYER1	: ON	OFF		⑤
LAYER2	: ON	OFF		⑤
LAYER3	: ON	OFF		⑤
TIDE DIF DSP	: ON	OFF		⑥
DRIFT DSP	: DRIFT	SPEED	OFF	⑦
EVENT	: ERASE (0)			⑧
TEMP DSP	: ON	OFF		
(Note 3) ECHO LEV DSP	: COLOR	GRAPH		⑨
(Note 4) BACKGROUND	: NORMAL	1	2	3 ⑩

▲▼ Knob ◀▶ Knob

①Press MENU key to store the settings and to erase the menu window.

②Reference layer for tide differential measurements

③Averaging time for tide display (0 to 5 min in 1 min steps)

④Tide history sampling time interval (15 sec, 1 min, 5 min, 10 min, 30 min or 1 hour)
Tide data of last 24 samples are kept in memory.

⑤Tide vector display on/off switch for each layer

⑥Tide differential vector display on/off switch

⑦On/Off switches for drift scale display and ship's speed vector display in the vector graph section

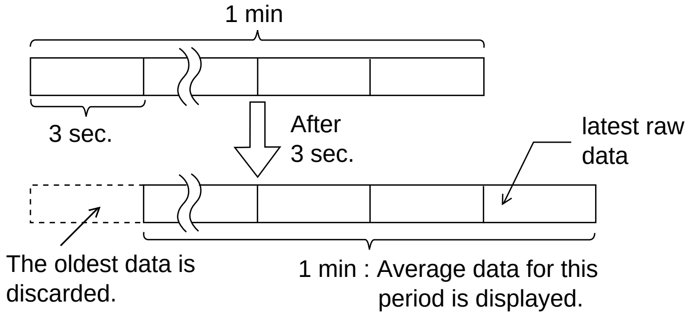
⑧To clear all event points (and marks), place cursor on "ERASE" and press EVENT key.
(Number in parentheses indicates number of event points stored.)

⑨Presentation mode of echo level display
"COLOR": Color sounder mode (echo strengths in color gradation)
"GRAPH": A-scope mode (echo strength in amplitude varying with depth)

⑩Background color (Select according to local lighting conditions.)
"NORMAL": Darkgreen "1": Darkblue "2": Gray "3": Darkgray

NOTE 1

* Raw tide data is obtainable every 3 sec.
Tide averaging time of "1 min" means that averaged data for last one minute is displayed.



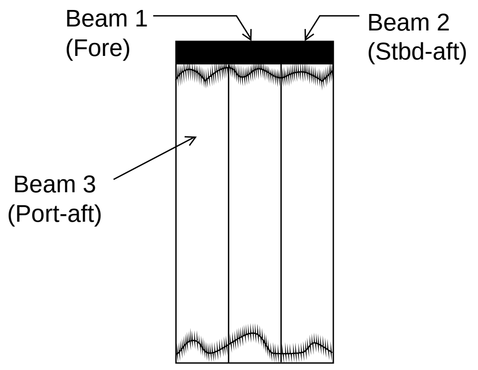
(Note) Averaging time of "0 min" does not mean immediate display of raw data but average of 15 seconds.

NOTE 2

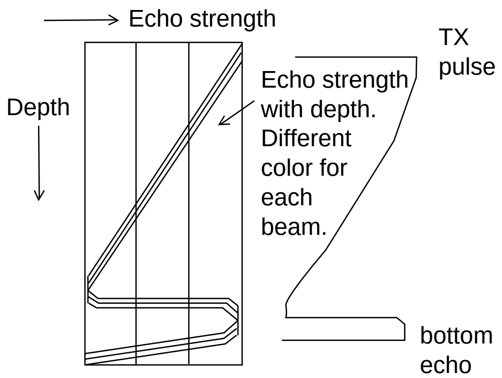
If tide vector display of a layer is switched off, the colored block circumscribing that layer number (in the fundamental data section) extinguishies.

NOTE 3

ECHO Level Presentation Mode.



COLOR GRADATION
(Color sounder)



AMPLITUDE GRAPH
(A-scope)

NOTE 4

Menu items displayed in red (e.g., BACKGROUND) indicate they are protected against accidental change of setting.
If a setting absolutely must be changed follow the procedure below. Be ware, however, that needless change may seriously affect performance.

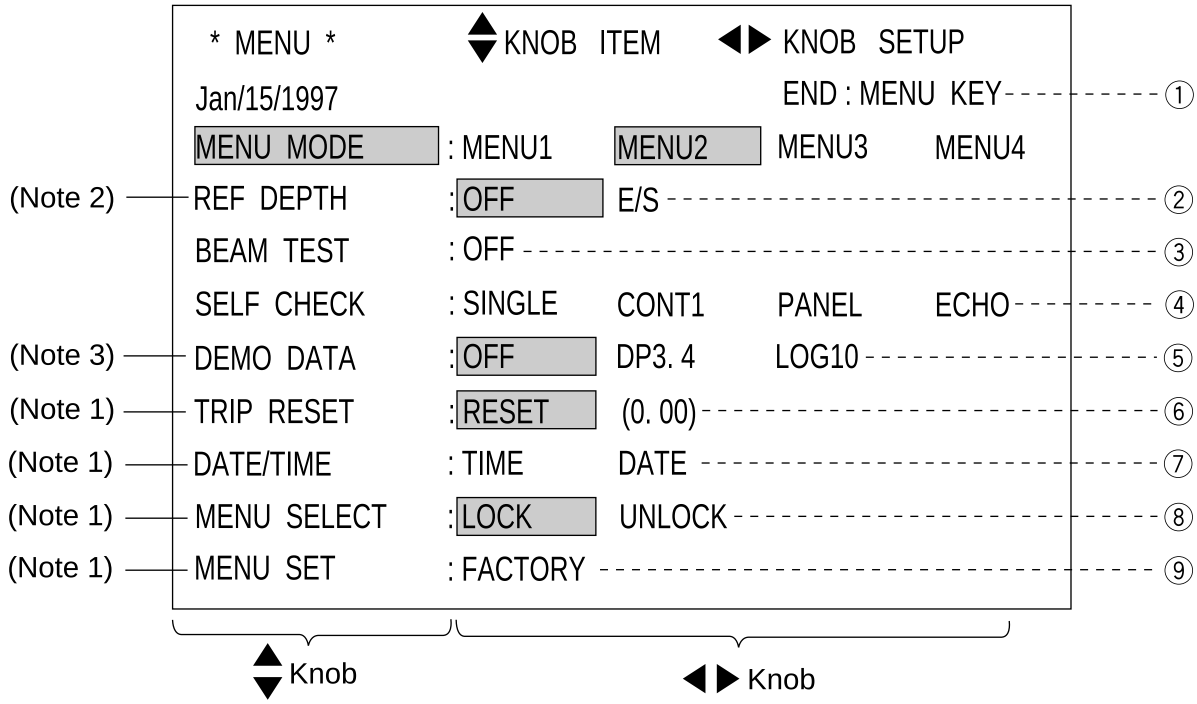
1. Place vertical cursor on a locked (protected) item by ▲▼ knob.
2. Turn ◀▶ knob clockwise by one step. The following message appears.

```
MENU SELECT IS LOCKED ◀▶ SET TO UNLOCK
[UNLOCKED] [NO] YES
PRESS EVEN KEY TO ENTER
```

3. Turn ◀▶ knob clockwise by one click to select "YES", and then press the [EVENT] key.
4. Place horizontal cursor on desired option by ◀▶ knob.

You can unlock all protected items. For details see the next page.

MENU 2 (NOTE 1)



①Press [MENU] key to store the settings and to close the menu window.

②Selection of reference depth data source for bottom search in ground tracking mode
"OFF": internal "E/S": depth data from external echo sounder

③Shows beam number(s) being tested.
"OFF": Test off (normal operation) "F1": Testing beam 1
"F12": Testing beams 1 and 2 "F13": Testing beams 1 and 3
"F23": Testing beams 2 and 3

④Test method and test item selection switch (See page 4-2.)

⑤Simulation data selection for demonstration
"OFF" for normal operation (See note 3 below.)

⑥Clear (zero) the total mileage count. (Value in parentheses shows total mileage.)

⑦Calls time set or date set sub-window.

⑧Lock/unlock switch for all the protected preset items shown in red letters.

⑨Restore factory settings.

NOTE 1

Menu items shown in red are protected (or locked) to prevent accidental change of setting.
To change the setting of a protected item, follow the procedure below.

1. Place the vertical cursor on the item by using ▲▼ knob, and then turn ◀▶ knob clockwise by one step. The following message appears.

```
MENU SELECT IS LOCKED   ◀▶ SET TO UNLOCK
----------------------------------------
UNLOCKED        NO        YES
      PRESS EVENT KEY TO ENTER
```

2. Turn ◀▶ knob clockwise by one step to select "YES", and then press the EVENT key.
3. Place the horizontal cursor on desired position, and press the EVENT key. There is no option item for "TRIP PRESET" and "MENU SET". Do not turn knob, but press the EVENT key immediately.

To unlock all protected items, place the cursor on MENU SELECT UNLOCK. Change of any protected item setting must be done with the greatest if caution, otherwise measuring accuracy may be degraded.

DATE/TIME settings

1. By using ▲▼ knob, place the vertical cursor onto "DATE/TIME", and then turn ◀▶ knob clockwise by one step. When you see the alert message window, turn◀▶ knob clockwise by one step again to select "YES". Press EVENT key to proceed to data/time setting sequence.
2. Place the horizontal cursor onto "TIME", and then hit the EVENT key.
   The "TIME SET" sub-window should appear as shown below.

```
*TIME SET*        ▲▼KNOB ITEM  ◀▶ KNOB SETUP
---------------------------------------------
        HOUR    :  18
        MINUTE  :   0
        SECOND  :   0
   PRESS EVENT KEY TO ENTER
```

3. Select HOUR, MINUTE and SECOND by ▲▼ knob, and at each, turn◀▶ knob to set correct value. (Set a time 10 to 30 seconds ahead of actual time so you can press the EVENT key at the tone of a time signal.)
4. Place the horizontal cursor to "DATE", and the press the EVENT key. The "DATE SET" sub-window appears. Set "YEAR", "MONTH" and "DAY" with the arrow knobs.

NOTE 2

REF DEPTH selection

Used to select reference depth data source for searching bottom echo in ground tracking mode.

"OFF": Bottom search by its own sounding (internal)
"E/S": Bottom search by using depth data from external echo sounder as a reference. Tracking mode ID will be "EXT" instead of "GT".

If external depth data is not available, despite the selection of "E/S", an alert message appear on the bottom part of the display. (Error number 103)

NOTE 3

DEMO DATA selection

Used to check the equipment or to enable the demonstration by simulation signals generated internally. Bearings depend on heading input.

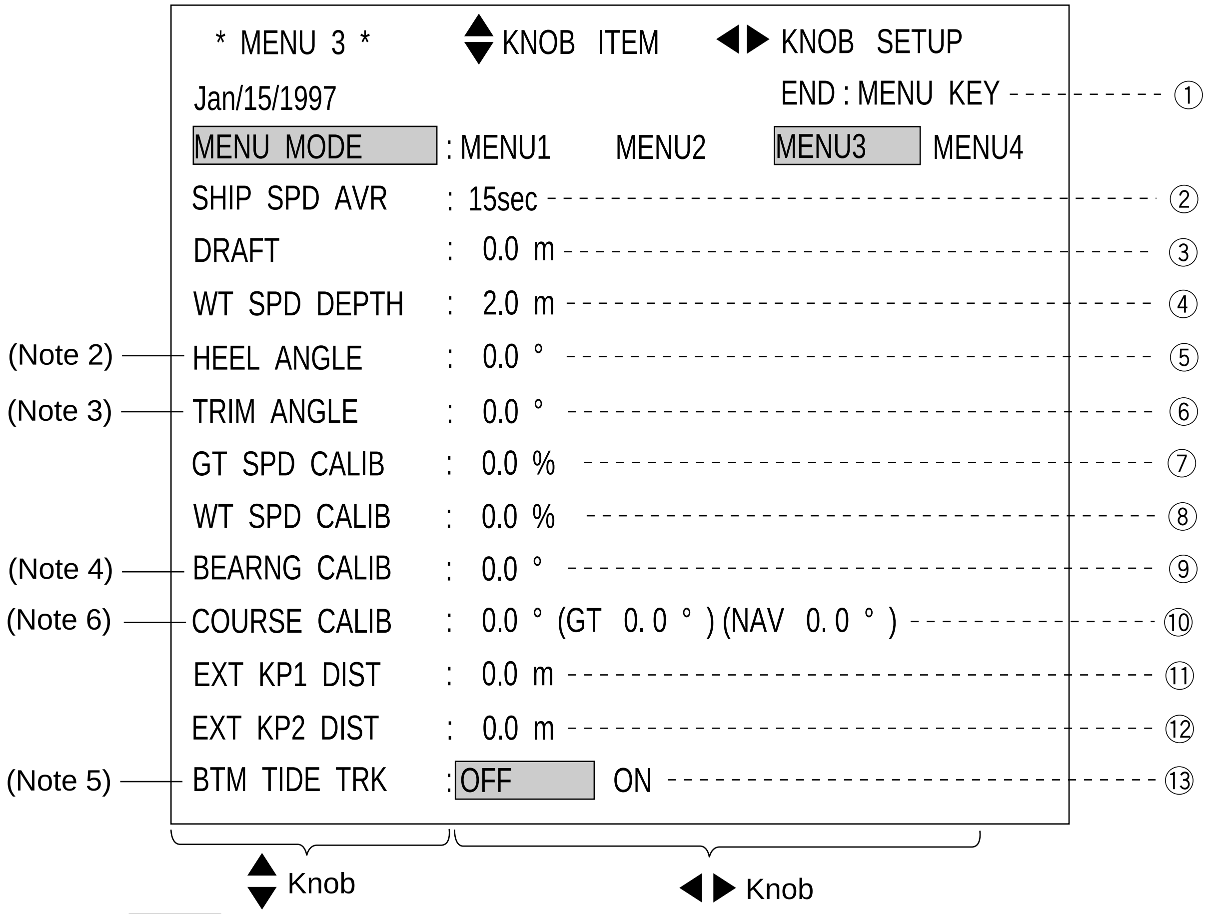
"DP3.4" .....

	3.4 kt	**N/E** 10°
1	**3.4** kt	**N/E** 10°
2	**3.4** kt	**N/E** 10°
3	**3.4** kt	**N/E** 10°

"LOG10" .....

10.0 kt	**N** 0°

MENU 3 (NOTE 1)



①Press MENU key to store (validate) the settings and to close the menu window.

②Averaging time for ship speed/course display......(15/30/60/90 sec)

③Draft level; i.e., depth of transducer from sea surface......(0.0 to 25.6m)

④Reference depth to measure ship's speed in water tracking mode......(2.0 to 25.6 m)

⑤Lateral (port-starboard) inclination angle (-12.8 to +12.7°)
  "-": starboard-high "+": port-high

⑥Fore-aft inclination angle (-12.8 to +12.7°)
  "-": aft-high "+": fore-high

⑦Ship speed offset in ground tracking mode

⑧Ship speed offset in water tracking mode

⑨Bearing offset angle of transducer (-12.8 to +12.7°)
  "-": transducer's fore-aft axis deviated to port
  "+": transducer's fore-aft axis deviated to starboard

⑩Offset angle to align course by CI-35/35H and course by external naviator [GPS] (-12.8 to +12.7°)
(GTx.x and NAVx.x are offset angles calculated by "CRS CALIB EXEC" operation in MENU 4.)

⑪Distance between transducers of CI-35/35H and other sounding device which is connected to the CI-35/35H as interfering source 1. (KP1)

⑫Distance between transducers of CI-35/35H and other sounding device which is connected as interfering source 2. (KP2)

⑬Used to select depth setting of layer 3.
  "OFF": Manual setting
  "ON": Automatic tracking on near-bottom tide

NOTE 1

All the items in MENU 3, except “MENU MODE”, appear in red to show that they protected (or “LOCKED”) items.

To unlock an item;

1. First, place the vertical cursor on the desired item by ▲▼ knob, and then rotate ◀▶ knob clockwise by one step. The following appears on the display.

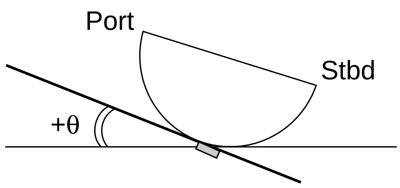
```
MENU SELECT LOCKED        ◀▶ SET TO UNLOCK
      UNLOCKED         NO          YES
   PRESS EVENT KEY TO ENTER
```

2. Turn ◀▶ knob clockwise by one step to select “YES”, and hit the [EVENT] key.
3. Protected item is now unlocked. Turn ◀▶ knob to set desired value or option. Press the [EVENT] key to store new setting(s).

As noted previously you can unlock all protected items. Beware, however, that change of setting may adversely affect equipment performance. Caution before changing any setting.

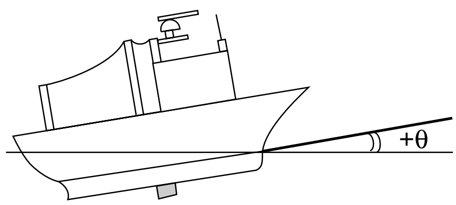
NOTE 2 HEEL ANGLE

Enter minus value if the boat (and transducer face) is inclined to port side.



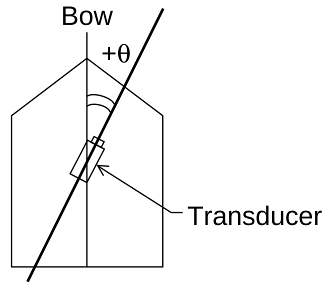
NOTE 3 TRIM ANGLE

Enter minus value if the boat (and transducer face) is inclined to fore side.



NOTE 4 BEARING CALIB

Enter minus value if transducer’s fore-aft axis is oriented to port side of ship’s bow.



NOTE 5 BOTTOM TIDE TRACKING

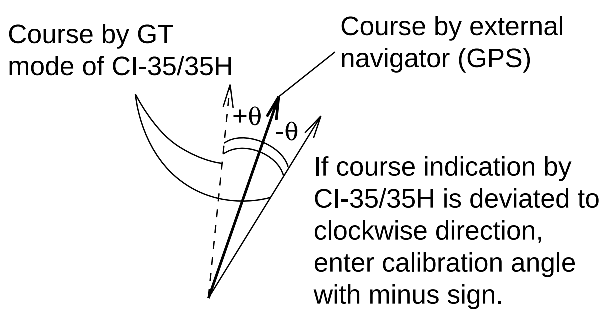
In the ON position, messuring depth of layer 3 changes automatically with the bottom depth to track on near-bottom tide.

If it is “OFF”, normal selection of measuring depth is attainable for the layer 3.

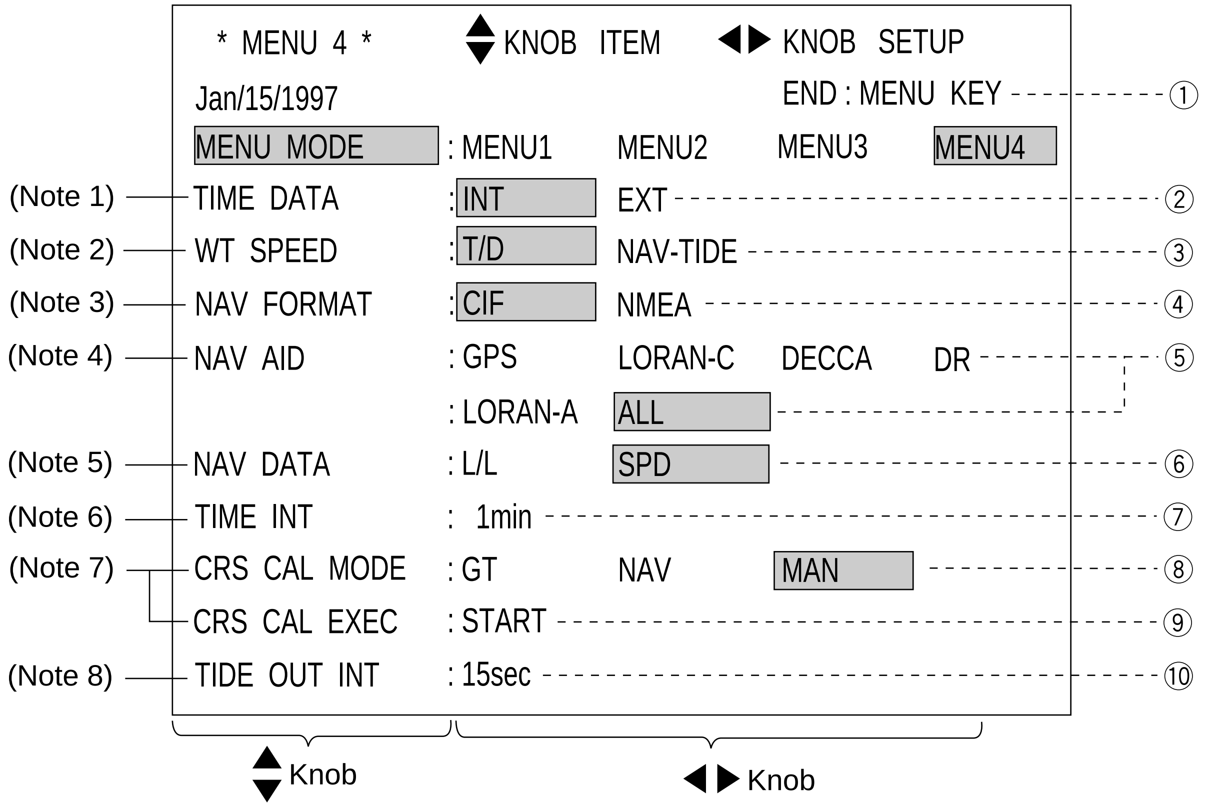
NOTE 6 COURSE CALIB

If course indication by ground tracking mode differs from that of navigator (GPS) even with a correct bearing calibration, enter the course calibration angle.

* Course calibration angle entered here will be in effect only when “CRS CAL MODE” is set to MAN in MENU 4.
* The way to automatically calculate and enter calibration angle is provided in MENU4. (See “CRS CAL EXEC” on the next page.



MENU 4



①Press MENU key to store (validate) the settings and to close the menu window.

②Selection of date/time display by internal clock (CI-35/35H) or external navigator's clock (GPS)

③Selection of tracking mode when ground tracking unattainable (water tracking or nav-aided)

④Selection of communication data format with external navigator (Furuno CIF or NMEA0183)

⑤Selection of source navigator to receive spd/pos data

⑥Selection of source data for ship's speed/direction display in nav-aided mode

⑦Averaging time for converting position change into speed/data(1 to 10 min in 1 min steps, effective only when selected "L/L" as NAV DATA above)

⑧Selection of method for automatic cource calibration calculation and calibration mode to use
"GT": Calculates course calibration angle to equalize ground tracking course to that of external navigator after 2 mile run.
"NAV": Calculates course calibration angle to equalize tides before and after 10 minute period.
"MAN": Calculates course by using value entered manually in MENU 3-COURSE CALIB.

⑨Used to calculate course calibration angle if "or" is selected in CRS CAL MODE adove. (Press EVENT key to start.)

⑩Selection of data output interval (15sec, 30sec,1min, 2min, 5min or 10min)

NOTE 1 **TIME DATA**

"INT": Displays date/time of internal clock in CI-35/35H. Time setting must be done manually in MENU 2-DATE/TIME. Time increments in every one second.

"EXT": Displays date/time received from external navigator. Generally, time is more accurate than internal clock, but it may not increment in one every second.

NOTE 2 **WT SPEED**

"T/D": Displays ship's speed, tide and tide dif. by using data obtained by CI-35/35H alone. With "T/D" selected, pressing TRACK MODE key changes GT/WT/AUTO.

"NAV-TIDE": Displays ship's speed, tide and tide dif. by referring to the data from external navigator. With "NAV-TIDE" selected, pressing TRACK MODE key changes GT/NAV/AUTO.

NOTE 3 **NAV FORMAT**

"CIF": Furuno CIF format. It is desirable to use this format to get most accurate nav-tide.

"NMEA": World standard format. Select this format only when CIF is not available. (This may not provide accurate nav-tide because of its longer update interval.)

NOTE 4 **NAV AID**

Selects a data source (talker) if multiple nav aids are connected.

- Select "GPS" if available. (Degraded performance with the other nav aids.)
- With NAV DTA set to "ALL", CI-35/35H automatically selects a highest priority talker available.

Priority: GPS>Loran-C>Decca>DR(Satnav)> Loran-A

NOTE 5 **NAV DATA**

Selects sourse data for pseudo ground tracking speed.

"L/L": Calculates speed/course internally from position data change. (Averaging time interval can be set in TIME INT.)

"SPD": Takes speed/course data from external navigator as they are. (Select "SPD" if connected with GPS.)

NOTE 6 **TIME INT**

If "L/L" is selected as NAV DATA, specify averaging time interval in TIME INT.
(1 to 10 min in 1 min steps)
Longer interval eliminates display fluctuation of speed and tide, but the response becomes slower.
1 min will be suitable to work with GPS.

NOTE 7 **CRS CAL MODE / CRS CAL EXEC**

Automatic Course Calibration Procedures

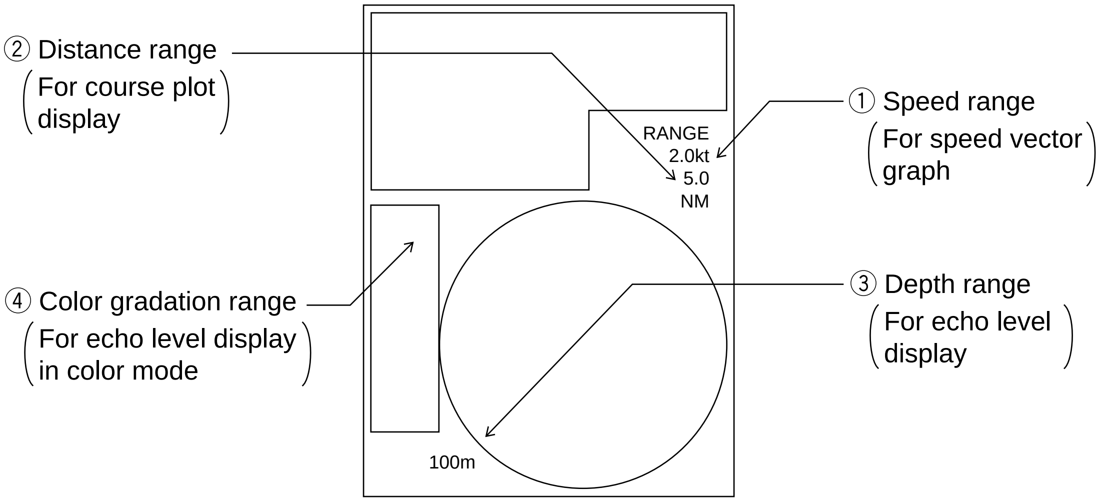
- "GT" mode (if ground tracking attainable)
  1. Select GT mode by TRACK MODE key.
  2. Set CRS MODE to "GT".
  3. Run at around 10 kt keeping same direction.
  4. Set cursor on CRS CAL EXEC - "START", and press EVENT key. (calibration start) Course calibration will be completed after you run 2 n.m.

- "NAV" mode (if ground tracking unattainable)
  1. Select NAV mode by TRACK MODE key.
  2. Set CRS CAL MODE to "NAV".
  3. Run at around 10 kt keeping same direction.
  4. Set cursor to CRS CAL EXEC - "START", and press EVENT key. (calibration start)
  5. When you have run for 5 minutes, turn your head by 180° and return to the start point. Course calibration will be completed after you run 10 minutes. (to go and return)

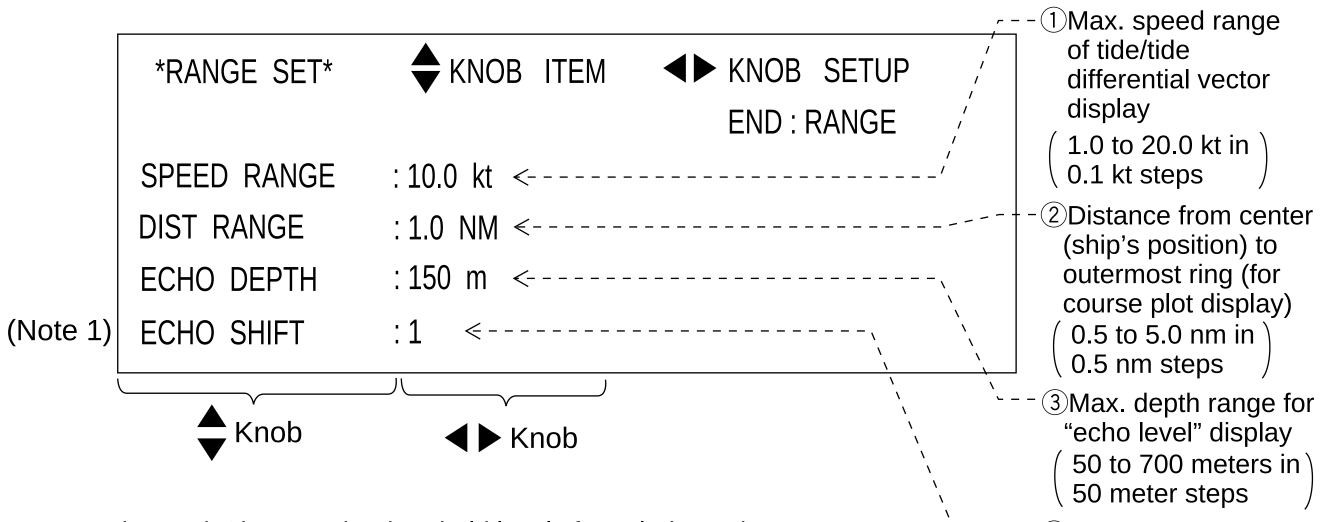
NOTE 8 **TIDE OUT INT**

Specify data output interval if a data logging device is connected to AUX port of the transceiver.
(Note that the CIF and NMEA data output intervals are not affected by this setting.)

2. RANGE SET MENU



1. To change one of the above ranges, call the RANGE SET menu by pressing the [RANGE] key.



(Note 1) Changes the threshold levels for coloring echoes with different strengths. (The higher the value, the lower the thresholds, and vice versa.)

A gradation factor of 1 to 7 is recommended. The higher (lower) the value, the greater the amount of red (blue) in echoes.

Notice that the threshold shift dose not change the receiver gain nor performance of the equipment, although it changes echo color.

2. When desired range is set, press the [RANGE] key again.

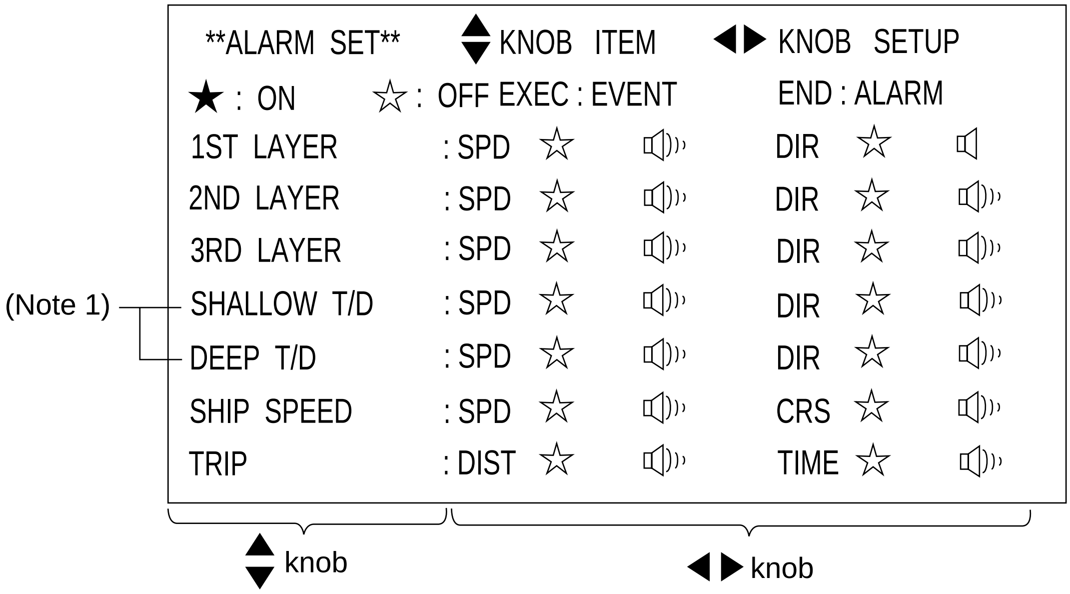
3. ALARM SET MENU

The ALARM menu permits selection of alarm sources and alarm parameters.

ALARM FOR TIDE/TIDE DIFFERENTIAL/SHIP'S MOVEMENT

This alarm is for alerting you to change in speed and direction of tide/tide dif./ship's movement.

- ◌ : Alarm range not set. (factory default)
- ☆ : Alarm range (zone) is preset, but alarm function is inactive.
- ★ : Alarm function is active.
- 🔈 : Audible alarm is disabled. (Speaker OFF)
- 🔊 : Audible alarm is enabled. (Speaker ON)



(Note 1)

SHALLOW T/D : Tide difference between base layer and the shallower of the other two layers.

DEEP T/D : Tide difference between base layer and the deeper of the other two layers.

REF. LAYER	SHALLOW T/D	DEEP T/D
1	1 → 2	1 → 3
2	2 → 1	2 → 3
3	3 → 1	3 → 2

ALARM setting procedure

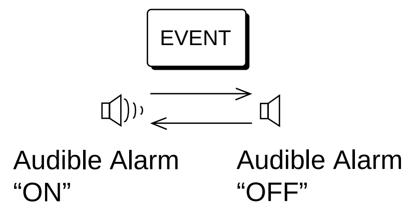
1. Call “ALARM SET” menu by pressing the [ALARM] key.

2. By the ▲▼ knob, place the vertical cursor an the desired item; then select an option item by the ◀▶ knob.

3. Press the [EVENT] key. The subsequent action depends on the location of the horizontal cursor.

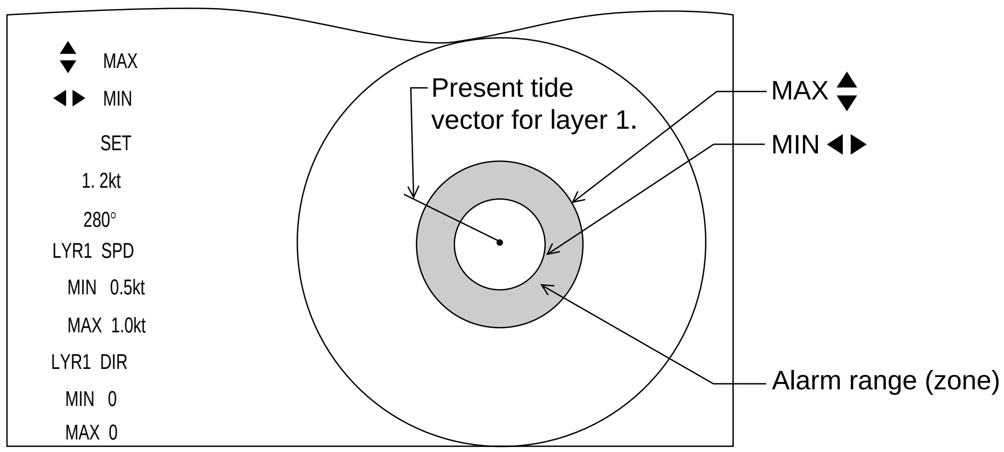
   1) When the horizontal cursor is on a speaker mark, the [EVENT] key functions to turn the audible alarm OFF “🔈” or ON “🔊”.

      Note that the audible alarm sounds for the items with a filled star mark “★” beside them.



   2) When the horizontal cursor is on an item which has the hollow star “☆” aside it or no star mark, the range set display appears.

Ex. Selected “LAYER1” - “SPD☆”



As necessary, change alarm range (zone) by ▲▼ knob (MAX) and ◀▶ knob (MIN), and then press the [EVENT] key. The hollow star “☆” changes to the filled star “★” to indicate the alarm setting is valid (or active).

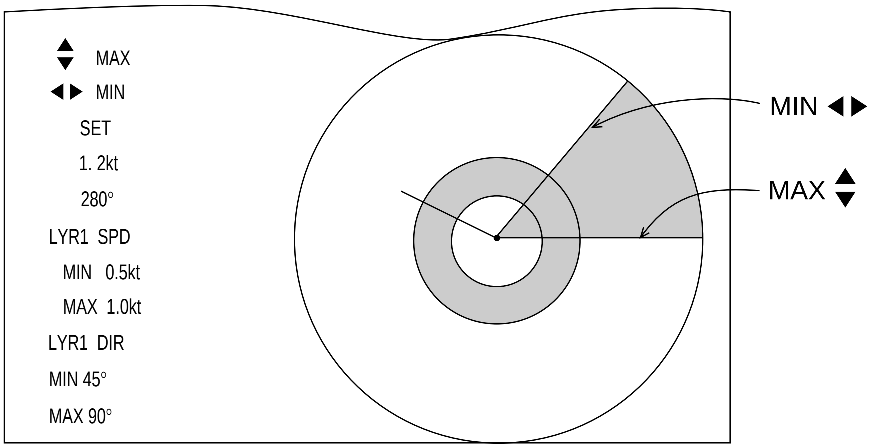
3) When the horizontal cursor is on an item which has the filled star mark “★”, beside it, the following sub-menu appears.

```
ALARM/ALARM ZONE SETTING        ◀▶KNOB SETUP
SELECT      : SET ZONE    STOP ALM
PRESS EVENT KEY TO ENTER
```

To make alarm setting valid;

① Place the horizontal cursor on “SET ZONE” by ◀▶ knob, and press the [EVENT] key. The alarm zone setting display appears.

EX. Selected “1ST LAYER” - “DIR★”



② As necessary, change alarm zone by ▲▼ (MAX) and ◀▶ (MIN), and then press the [ENTER] key.

To make alarm setting invalid;

① In the alert message window, select “STOP ALM” by ◀▶ knob, and press the [EVENT] key. The filled star “★” aside the option item changes to the hollow star “☆” to show the alarm setting is now invalid. (Alarm zone settings are preserved, but they do not trip the alarm.)

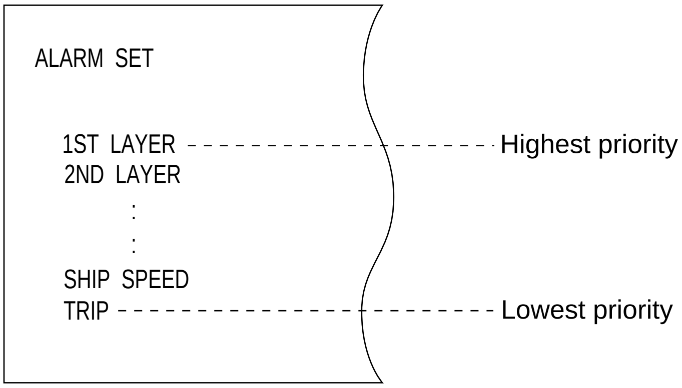
4. After entering the alarm/alarm zone, press the [ALARM] key to store the settings and to close the alarm menu window.

5. When the conditions of an alarm are breached, with ship’s movement or tide movement, the alarm message starts blinking at the bottom part of the display. If the audible alarm is enabled for that item, the alarm sounds.

- To cease the audible alarm, call the alarm menu and disable (OFF) the audible alarm (🔊 → 🔈), or make the alarm setting invalid (“★” → “☆”.)
- To mute the audible alarm temporarily, turn the VOLUME control counter-clockwise.

Alarm Priority

Alarm priority is in the order as listed the Alarm menu.



If multiple alarm conditions are violated, alarm having the highest priority is presented as a visual alarm at the bottom of the display.

There is no priority for the audible alarm; the alarm is released whenever an alarm parameter is violated.

ALARM FOR TRIP DISTANCE AND TRIP TIME

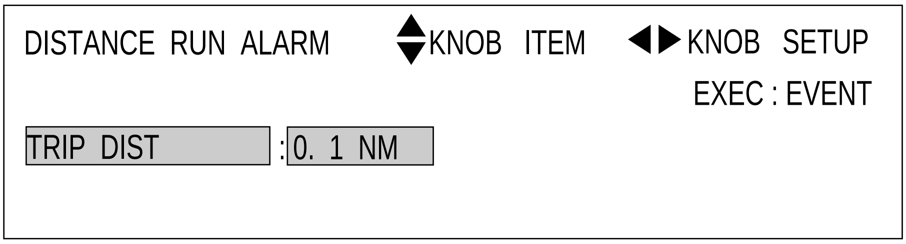
Two basic functions are included in the alarm facility:

- Generates the alarm when preset trip time or trip distance is reached.
- Measures distance-run for a certain preset period, or to count time-elapsed to run a certain preset distance.

Procedure

1. In the alarm menu, select "TRIP" item by the ▲▼ Knob.

   A. To set a distance limit, turn ◀▶ knob for "DIST (☆)" option, and then hit the EVENT key. The following sub-window appears.



Turn ◀ ▶ knob to set a distance-run, and then hit the EVENT key.
A filled star mark “★” appears aside “DIST” to show the distance alarm setting valid. To start counting distance, press the TRIP key. Note that the alarm distance counting is perfomed internally but not shown on the display. When the preset alarm distance is reached, time-elapsed display becomes red and the counting is stopped. If the audible alarm is enabled (“ ”), it is released.

B. To set a trip alarm, turn ◀ ▶ knob for “TIME☆” options and hit the EVENT key. The following sub-window appears.

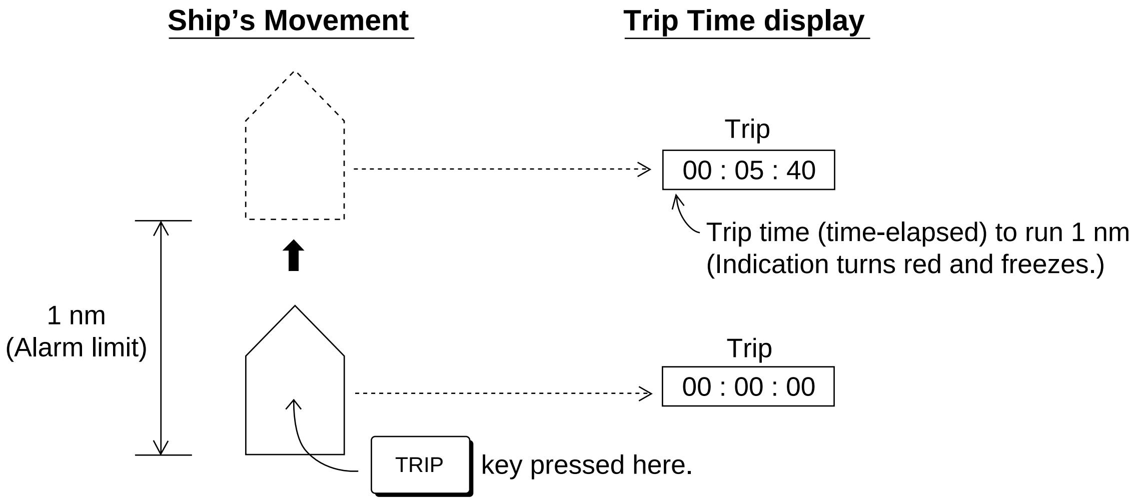
DISTANCE RUN ALARM		▲▼KNOB ITEM	◀▶KNOB SETUP
			EXEC : EVENT
TRIP TIME	: 0	HOUR	
	: 15	MINUTE	
	: 0	SECOND	

After selecting hour, minute and second by the ▲▼ knob, set your desired trip time (alarm limit) by the ◀ ▶ knob. Then, press the EVENT key to store the setting. A filled star “★” appears aside “TIME” to show the trip time alarm setting is valid.

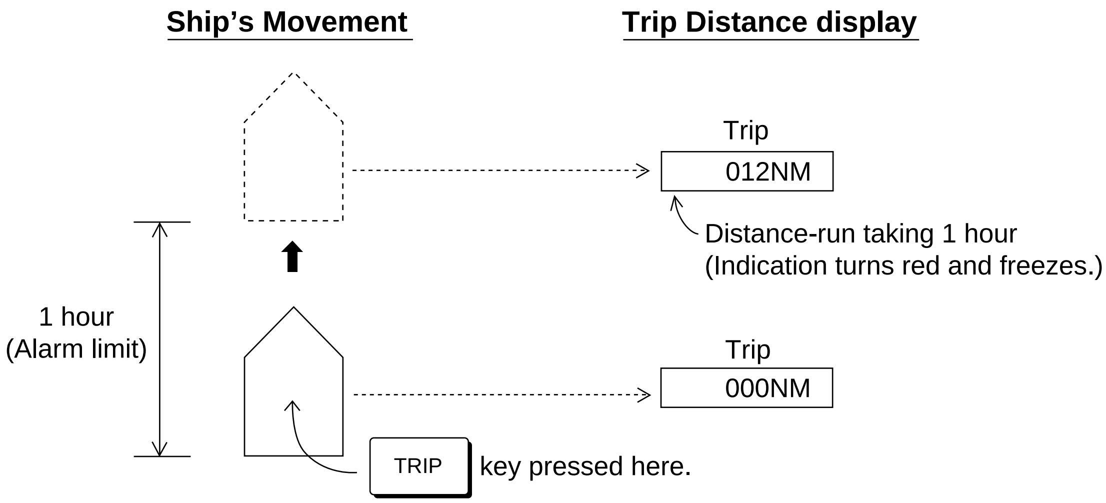
To start counting trip time, press the TRIP key. Note that the trip time counting is preformed internally, but not shown on the display. Instead, distance-run in the TRIP display frame counts up.

When the preset trip time is reached, the distance-run display becomes red and the counting is shopped. If the audible alarm is enabled (“ ”), it is released.

Example A. Trip distance : 1 NM



Example B. Trip time : 1 hour



CHAPTER 5. TROUBLESHOOTING

1. SELF-CHECK

The CI-35/35H has a self-test facility for general diagnosis of its major circuits. If an unusual symptom is encountered during operation of the equipment, perform the self-check. If the self check reveals equipment fault, shown by the error code, report the results to the service technician when calling for service. (The user should not attempt further check inside the equipment.)

⚠ WARNING



Do not open the cover of the equipment.

This equipment uses high voltage electricity which can shock, burn, or cause death. Only qualified personnel should work inside the equipment.

Procedure

1. Call menu window by the pressing the [MENU] key.
2. Select "MENU MODE" - "MENU 2" by the ▲▼ and ◀▶ knobs.

* MENU 2 *	▲▼ KNOB ITEM		◀▶ KNOB SETUP	
Jan/15/1997			END : MENU KEY	
MENU MODE	: MENU1	MENU2	MENU3	MENU4
REF DEPTH	: OFF	E/S		
BEAM TEST	: OFF			
SELF CHECK	: SINGLE	CONT1	PANEL	ECHO
DEMO DATA	: OFF	DP3. 4	LOG10	
TRIP RESET	: RESET	(0. 00)		
DATE/TIME	: TIME	DATE		
MENU SELECT	: LOCK	UNLOCK		
MENU SET	: FACTORY			

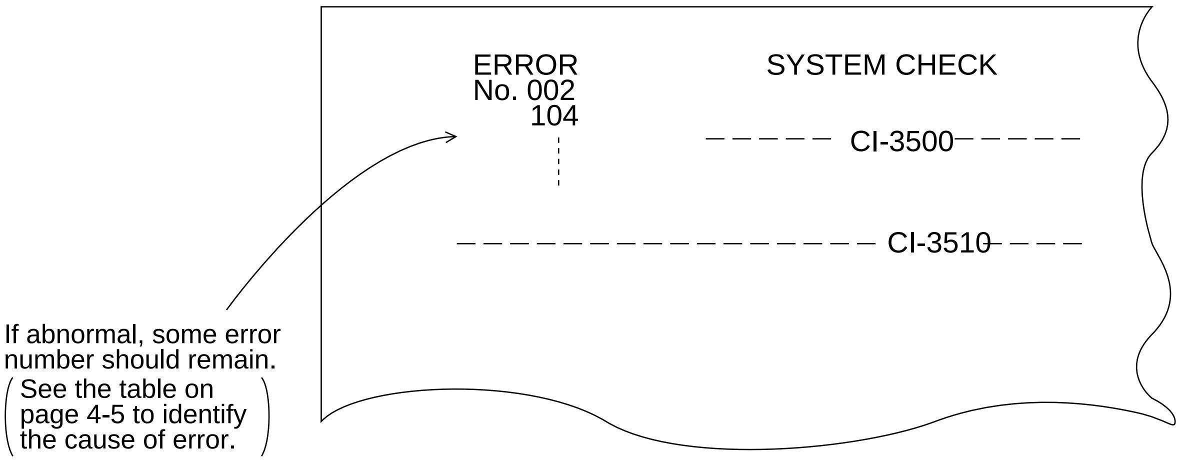
3. Place the item cursor on “SELF CHECK” by the ▲▼ knob, and then press the EVENT key. As this item is protected (locked), the following alert appears.

MENU SELECT IS LOCKED ◀▶ SET TO UNLOCK
UNLOCKED NO YES
PRESS EVENT KEY TO ENTER

4. Select ‘YES’ by the ◀ ▶ knob and press the EVENT key. The color of “SELF CHECK” turns green to show the item is unlocked.
5. Select a check option, SINGLE, CONTI, PANEL or ECHO by the ◀ ▶ key, and then press the EVENT key to start the self check.

SINGLE (single cycle)

The SINGLE test executes the system check for one cycle displaying the test result for each item checked. Items checked are ROM/RAM and P.C. boards for the Display unit and the Transceiver unit. Echo strengths from three transducers are also displayed in the ECHO LEVEL frame.



CONTI (continuous: repeat)

The CONTI test executes the system check repeatedly. To escape, press the MENU key.

PANEL

The PANEL test checks the front panel keys and controls for proper operation.

Press and release each key to see if it is making (1) and breaking (0) correctly. Also, turn ▲▼ and ◀ ▶ knobs to see if the step count changes from 0 to 63. (CW: count up, CCW: count down)

To terminate the PANEL test press the [MENU] key.

PANEL TEST

TIDE EFT	0	0	EVENT
DRIFT	0	0	CRS PLOT
TIDE DIF	0	0	HISTORY
TRIP	0	0	HU/NU
MODE	0	0	MAN TRK
ALARM	0	0	LAYER 1
RANGE	0	0	LAYER 2
MENU	0	0	LAYER 3

KNOB [▲▼]   KNOB [◀ ▶]

0   4

END: MENU KEY

ECHO

The ECHO test displays echograms for three transducer beams. This lets the service technician check the transmitter/receiver for proper operation.

The following key and knobs function to change receiving conditions.

KEY/KNOB	FUNCTION
[TRACK MODE]	TVG setting ON/OFF
▲▼	Depth range selection
◀ ▶	Echo strength (receiver gain)

To terminate the 'ECHO' check, press the [MENU] key.
(The CI-35/35H restarts in the same condition as if it is switched on.)

2. ERROR INDICATION

If the unit detects abnormal operation in the transceiver unit it displays a (blinking) message and a three-digit error code and releases the audible alarm. (Error indication will not interrupt the operation of the equipment.)

The error codes and the corresponding status are tabulated below. If multiple items are in error; only the latest error code appears.

ERROR CODE	ERROR STATUS (CHECK ITEM)
000	Abnormal main’s input voltage.
001	Overheated transducer
002	Abnormal TX high voltage (+B)
003	Abnormal TX voltage for beam 1
004	Abnormal TX voltage for beam 2
005	Abnormal TX voltage for beam 3
006	Abnormal TX current for beam 1
007	Abnormal TX current for beam 2
008	Abnormal TX current for beam 3
100	External position data is missing despite “WT SPEED” is NAV-TIDE and “NAV DATA” is L/L in MENU 4.
101	External speed data is missing despite “WT SPEED” is NAV-TIDE and “NAV DATA” is SPD in MENU 4.
102	External time data is missing despite “TIME DATA” is set to EXT in MENU 4.
103	External depth data missing despite “REF DEPTH” is set to E/S in MENU 2.
104	External heading data missing.
105	External bearing (course) data differs internal absolute bearing by more than 5˚.
106	External water temperature data missing
200	External keying pulse irregular
201	Abnormal temperature sensor input
202	Abnormal “roll” signal from inclinometer
203	Abnormal “pitch” signal from inclinometer

3. Internal Battery

A battery fitted inside the display unit preserves data when the equipment is turned off, and its is life is about five years. When its voltage is low no clock may display, etc. Contact your dealer to request replacement of the battery.

Parts Name	Type	Code No.
Lithium battery	ER6K	000-120-991

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SPECIFICATIONS

1. MEASURING RANGE

1) SHIP'S SPEED/COURSE

Speed:	[Fore-aft] -10.0kts to +30.0kts [Port-stbd] -9.9kts to +9.9kts
Direction:	All directions in one degree steps (0° to 359°) (relative and true bearing)
Speed Measurement Depth	
(Ground tracking mode):	3 m to 500 m beneath the keel (depending on sea condition)
(Water tracking mode):	2 m to 25.6 m beneath the keel (The measuring accuracy will drop for the depth shallower than 40 m)70 m or deeper (with wide pulse)

2) TIDE SPEED/DIRECTION

Speed:	0.0 to 9.9 kts
Direction:	All directions in one degree steps (0° to 359°) (relative and true bearing)
No. of measuring layers:	CI-35: 3 layers fixed CI-35H: Maximum 11 layers (10 at constant interval between maximum and minimum preset depths, and a layer preset manually)
Tide measurement depth:	2 m to 200 m beneath the keel (depending on sea condition) Clearance of more than 15m required for Ground Tracking Mode, 40m required for Water Tracking Mode
Measuring Interval	0, 1, 3, 4 and 5 minutes

2. MEASUREMENTMODE

1) AUTOMATIC	preset to Ground Tracking mode in measurable depth range, and switched to Water Tracking mode out of measurable range for Ground Tracking.
2) GROUND TRACKING	fixed to Ground Tracking mode irrespective of depth
3) WATER TRACKING	fixed to Water Tracking mode irrespective of depth

3. DISPLAY

1) DISPLAY DEVICE	12" high-resolution color CRT

2) TEXT DISPLAY ITEM (in table form)

Ship's real speed:	xx.x(kt)	
Ship's course:	xxx(°) or 32-point notation	
Tide speed:	x.x(kt) (for 3 layers)	
Tide direction:	xxx (°) or 32-point notation (for 3 layers)	
Depth of tide layer:	xxx (m) (for 3 layers)	
Total mileage:	xxxxx. xxx (nm)	
Present time:	xx (h) xx (m) xx (s)	
Ship's heading:	xxx. x (°) (external data)	
Optional text display (display on/off switchable)		
Tide differential speed:	x. x(Kt)	
Tide differential Direction:	xxx (°) or 32- point notation	
Lateral speed:	xx. x(Kt)	
Drift angle (leeway angle)	xx(°)	
Trip distance:	xxxx. xx (nm)	(one at a time)
Trip time:	xx(h)xx(m)xx(s)	(one at a time)
Water tracking speed:	xx. x(kt)	
Water tracking course:	xxx(°) or 32-point notation	
Optional text display (available when external data source is connected)		
Water temperature:	xx. x(°C)(Needs external temperature data)	

3) GRAPHIC DISPLAY

Tide vector: Tide speed and direction for each layer are presented by length and orientation of a radial vecor bar. Color of vector bar represents layer. (North-up presentation selectable if external heading input is available.)

Tide differential vector: Speed and direction of tide differential are presented by length and orientation of a radial bar. Colors of vector bar represent the layers involved.

Echo level: Variation of echo strength with depth is presented either in color sounder mode or in A-scope mode. (simultaneously for the three sounding beams)

Optional graphic display (display on/off switchable)

Course track plot: Ship's course track display consisting of the last 200 sampling points is presented in ship-centered format. (Display switchable on/off)

Tide history: Tide vectors recorded at last 24 sampling points are presented on one screen. (24 hours max.)

Tide effect: Simulated movements of tide layers along the ship's track. (Display switchable on/off)

Optional text display (available when external data source is connected.)

Water temperature: Water temperature graph covering the 17.5 minutes is displayed. (External temperature data input required.)

4. ACCURACY

1) SHIP SPEED	±1 % or ± 0.1 kt
2) TIDE SPEED	±2 % or ± 0.2 kt
3) DIRECTION	±3.5 °(depending on sea condition)

5. TRACKING SPEED

1) SHIP SPEED	Less than 40 sec.
2) TIDE SPEED	Less than 60 sec.

6. SOUNDING FREQUENCY

130kHz approx.

7. DATA INPUT

1) HEADING DATA Clocked-serial (AD100) 1ch

2) KEYING PULSE (for interference rejection) Current loop signal 2ch

3) MISCELLANEOUSSerial (IEC1162, equivallent to NMEA0183) 1ch

Heading; ($--HDT/HDM/HCD/HCC)
Depth; ($--DBS/DBT/DBK)
W-temp; ($--MTW)
Date/time; ($--ZDA/ZLZ/ZZU) --:any talker

8. DATA OUTPUT

1) LOG SIGNAL

200 pulses/nm Contact signal, forward only 2ch
(contact rating 0.2A/30V max.)

400 pulses/nm TTL level, forward only 1ch

2) EXTERNAL ALARM Contact rating 0.2A/30V)

Speaker output 1ch
(800mW into 4 to 8 ohms)

3) MISCELLANEOUS Serial (IEC1162, equivallent to NMEA0183)................. 1ch
Speed/course($VDVTG/VBW/VHW)
Set & drift ($VDVDR)
Tide spd/dir ($VDVCD)
Current ($VDCUR)
Serial (Furuno CI-7000 format) for data recording 1ch
(Date/time,ship's speed/course, tide speeds/directions,water

4) ANALOG SHIP SPEED	Current signal for Analog Display.
	-3.33mA to 10.0mA/-10kt to 30kt (Maximum load 400 ohms)
5) TRUE BEARING DATA	Clocked-serial (Furuno AD-100 format) 1ch

9. MISCELLANEOUS FUNCTIONS

Self-check function,
Simple demonstration function

10. NAV-AIDED TIDE MEASUREMENT

Even where ground tracking is unattainable, absolute tide movements (tide on ground) can be calculated by applying accurate position and heading data to CI-35/35H. This function may be extremely useful for deep sea purse seining or oceanographic survey.

Note: 1. Depths are measured below transducer surface.
2. The CI-35/35H uses an acoustic wave for speed measurements. Aeration due to rapid accelera tion/deceleration, heavy engine/propeller vibration or interference from other sounding equipments can degrade performance of this equipment.
3. Tide speed measuremants are made by detecting echoes from underwater microscopic objects like plankton. If density of microscopic objects is too high or too low, depending on season or operating areas, CI-35/35H may not provide normal measuring performance.

11. ENVIRONMENTAL CONDITIONS

1) Temperature:	0 to 45°C
2) Humidity:	80%RH (without condensation)

12. POWER SUPPLY

Main's input:	100/110/115/220/230VAC,50/60Hz,1ø
Power consumption:	100 - 240 VDC : 3.0 - 1.25 A

13. COATING COLOR

Display unit:	Front panel;	Munsell N1.5 Newtone NO.5 (not changed)
	Cover plate;	Munsell 2.5GY5/1.5(standard) or 2.5G7/2
Transceiver Unit:	Munsell 2.5GY5/1.5(standard)or 2.5G7/2	
Junction Box:	Munsell 2.5G7/2 (not changed)	

14. DISTRIBUTION BOX DS-370

1) Input Signal (TTL level)

Digital speed signal
Log signal (400p/nm)
Alarm signal
Power on/off signal

2) Output Signal

The following output boards are selective.
(7 boards max.)

(1) OTX board	Serial Signal for DS-350/351 Digital Indicator
(2) ODD board	BCD serial signal for MF11D (LCD spec. only),MF-22D, DS-720/DS-370/DS-377 digital display.
(3) OAD board	Analog current signal for Analog Display. (1 port /1 board), -2.5mA to 10.0mA/-10kt to 40kt or -3.33mA to 10.0mA/-10kt to 30kt
(4) OLG board	For Distance Indicator (1 port /1 board) and 200/400 p/nm , signal, 30V/0.2A or RS-422 current loop signal)
(5) OAC board	Ship's speed current voltage signal (1 port /1 board). Current signal (4.0mA to 20.0mA/-10kt to max. speed, max. impedance: 250 ohms)
(6) OAV board	Ship's speed voltage signal (1 port / 1 board). Voltage signal (-2.50V to 10.0V/-10kt to 40kt, -3.33V to 10.0V/-10kt to 30kt, -4.00V to 10.0V/-10kt to 25kt, -5.00V to 10.0V/-10kt to 20kt, max. impedance: 1 kohm) + Fore aft status signal(RS-422 current loop)

3) Power Supply and Power Consumption

100/110/115/220/230 VAC, 1ø, 50/60 Hz, 50 VA max.